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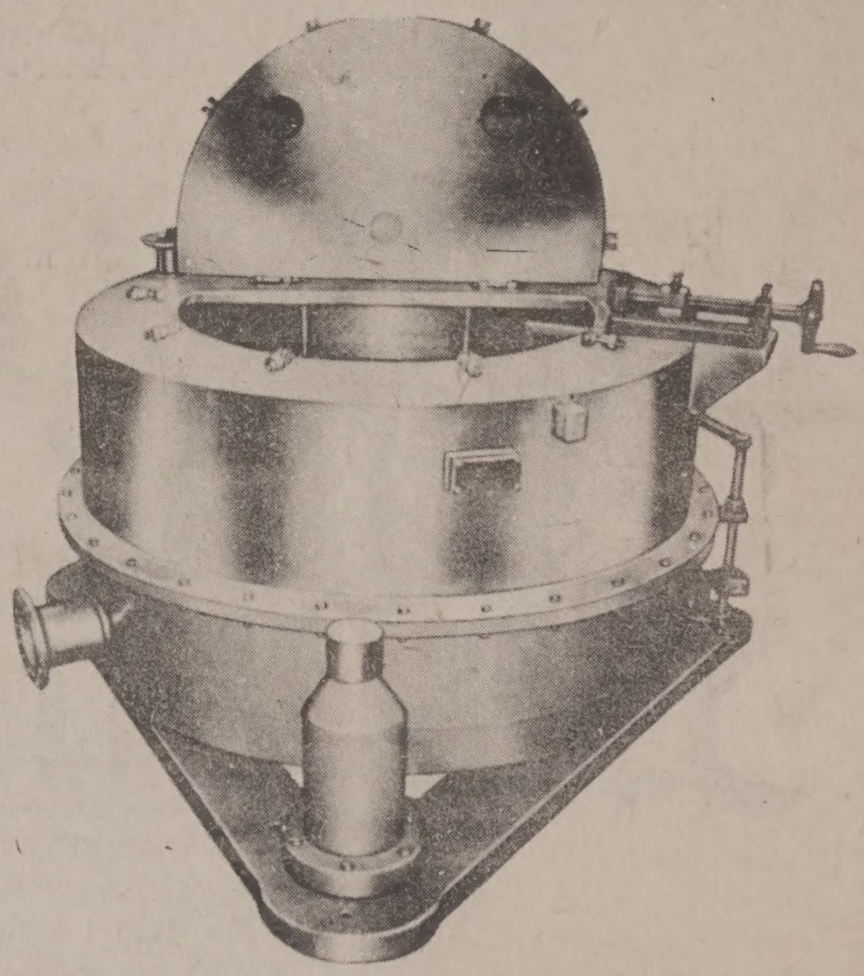

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CHEMICAL WEEKLY

VOL. XXXV JANUARY 16, 1990 NO. 19

HERALDING THE 21st CENTURY - 34

Factories in Space

The industrialisation of Space is imminent, this awesome challenge will make great demands of human talents and technology; but there will be many tangible rewards to which humanity at large can look forward to.

Today the prospects of building a factory in Space is neither a ntasy nor a novelty beyond the realms of feasibility. We are beginng to unlock the extraordinary potentials of automation. Already, ientists and engineers have learned to create machines that simate the dexterity, the physical senses, and -- in some cases -- even e thinking processes of human beings. Mankind has learned to se automation, not simply as a novelty, but as a powerful, pracal tool. Here on Earth, the practical uses of automation already val even the most exciting fictions. But the greatest challenge for botics awaits us not here on the ground but in space -- and spefically in its application to permanent space stations.

Space Stations and Robots: There is little doubt that robotic sysms will be an integral part of any permanent orbiting station. By eir very nature, these "factories in space" will be required to operte for extended periods of time without the aid of human crew or chnicians. Nor will it be economically feasible to send human troubleshooters into space every time repairs or adjustments are needed. s a result, the space stations now being planned will have to be elf sufficient to a much greater degree than conventional, earthound facilities.

Manufacturing processes carried out on board the station will need o be automated. But beyond that, robotic devices will be called pon to take the place of human technicians, both in diagnosing quipment malfunctions and in formulating and executing appropiate repair procedures. In addition, automated systems must in many ways exceed the capabilities of human technicians. Space is, after ll, a hazardous environment, and many service operations will be either too risky or too difficult for a human operator in a cumbersome pressure suit. The automated tooling and systems needed to fully capitalize on future robotic opportunities in space are already available here on Earth.

Integration: When we talk about establishing automated factories in space, it is important to remember that what we are proposing is not one single, self-contained system, but many types of equipment working in concert. Certainly, there will be automated work stations incorporating various types of processing and material-handling systems. But chances are, there will also be service robots, like ROSA; sensors and monitors; vision systems; computers and microprocessors. And in order for this space-based factory to function effectively, all of these systems will have to be able to communicate with each other, to work together as a unit.

The problem is that different machines generally have very little in common. They are designed for different purposes, and they are controlled by different devices using different operating systems and different control languages. The solution is an executive system that could act as a universal translator, a master utility that could do service as interpreter, moderator and commander-in-chief for all onboard systems and functions. One such control system -- Cell Management Language (CML) -- was recently developed by Westinghouse, in conjunction with the Robotics Institute at Carnegie-Mellon University. CML is a powerful, rule-based software language that uses artificial intelligence and advanced database techniques to manage communication and supervision within a single work cell, or among multiple work cells.

CML has the capability not only to accept input from many systems in a variety of languages, but also to translate communications between systems as needed. That makes operations a lot easier from the machine's point of view and also makes the human side of automation much simpler as well. In addition to being a relatively simple programming language to start with, CML automation programmes can be written using a graphic interface. That means that someone with little or no programming background -- such as a factory or process technician -- can operate the system with no need for specialized training. The automated tooling and systems needed to fully capitalize on future robotic opportunities in space are already available here on Earth. In one application or another, the essential technologies await only our decision to use them, either as they exist or in some appropriately modified form. This is not to say that no further challenges exist, or that the capabilities reviewed here are in any way the final world in automation technology. These systems represent only the first of many generations of robotic systems that will serve to transform the most distant possibilities of today into the practical realities of tomorrow.

Manufacturing Facility in Space: The first Industrial Space Facility (ISF) will be ready for launch by the end of 1990. This privately owned, human-tended, orbiting space facility will provide rental space for manufacturing materials in a microgravity environment. The ISF, being developed by Space Industries, Inc., of Houston, and Westinghouse Electric Corporation is expected to be used

first as a materials research laboratory and power source for a docked space shuttle, which will thus be able to remain longer in orbit. But many other uses are anticipitated. Business opportunities abroad the facility are expected to include:

* Purification of both pharmaceutical and biological products,
* Growth of large protein crystals to improve the quality and speed of engineering new drugs,
* Growth of large ultra-pure semiconductor crystals for high-speed computers and advanced electronic devices,
* Development of new polymers and catalysts,
* Containerless processing of improved fiber optics,
* Creation of metal alloys and other composites that cannot be produced on Earth.

The microgravity environment of the ISF will eliminate heat convention and hydrostatic pressure. It will also eliminate sedimentation and buoyancy, enabling the fusion of mixed particles or immscible liquids into homogeneous composites impossible to make on earth. The ISF will not be permanently manned, but it is designed to be habitable and will provide a 'shirt sleeve' work environment for astronauts when docked with the NASA space shuttle. The ISF is designed to work in tandem with the shuttle and will be in permanent orbit 200 miles above the Earth. NASA has already agreed to deliver two ISF's into space via the space shuttle.

As a major private-sector component of the space programme, the industrial space facility will provide a critical bridge between the resumption of shuttle flights and the launching of the NASA space station. The facility could also serve as a "construction shack" for building up the station and, once the space station is operational, provide it with special purpose buildings and production facilities. Space abroad the ISF is available for lease by private enterprise and governments beginning immediately from Space Industries, Inc. Space-based production of a wide range of materials -- semiconductors, alloys, glass and biological preparations -- is emerging as one of the most promising fields of cosmonautics. USSR has been conducting several hundred technological experiments involving different materials abroad automatic space probes and manned orbital stations, since 1976. The results are impressive, indeed: weightlessness has made it possible to modify the properties of these materials considerably. Compared to their terrestrial equivalents, the monogenity of the distribution of admixtures in space produced semiconductors increases considerably, while the density structural defect is cut by two to three orders of magnitude. Electrophoresis increases the degree of purification of biological preparations by 6-10 times, and the unit's efficiency by three orders of magnitude. On the other hand, vibration aboard orbital stations has turned out to be a major problem -- it spoils the properties of materials considerably. Some, other issues have to be resolved, too.

Space-based production of semi-conductors and biological preparations is a top-priority task. Such materials as gallium arsenide, cadmium sulfide, indium phosphide and germanium are widely used in electronics. However, while one kilogram costs several hundred thousand roubles to produce, space-based production of such materials will entail much greater expenditure. If it were possible now to begin using Photon automatic space probes, which are currently used to conduct technological experiments, the costs would soar considerably. Nevertheless, this is quite acceptable, considering the fact that product quality will improve drastically.

The production of protein-based biological preparations, producer cells, and monodispersion latex diagnostic substances, shows good prospects. While the growth of these protein crystals in terrestrial conditions is hampered by their weight, they can, however, be grown in zero gravity. It will also be possible to study their structure with a reentgenograph and eventually use genetic engineering fo production. Interferon, insulin and some other protein-based icines can also be mass-produced in orbit. Because their effi depends upon the degree of their purification, production co Earth are sky-high -- at present, a kilogram of interferon, for ple costs almost a billion roubles to produce. That's why production of protein-based preparations is quite profitable

Fodder vitamin producer cells, antibiotics and other organic stances will also be turned out on a mass scale. It is possible to a biologically pure strain of cells in space and to reproduce earth in the required amount; several grams of the substance suffice for this purpose. According to test results, producer obtained with the help of space-based technology have booste productivity of industrial fermenters (these are used in the pro tion of B2 fodder vitamins and antibiotics) by some 30%. In words, the utilisation of more active types of producer cells is valent to a sizeable increase in the capacities of biochemical pl the only difference is that one doesn't have to waste huge sum money on their modernization. Space biotechnology can be to process waste from the pulp-and-paper industry, as well as leftovers, yielding an annual benefit of several billion roubl

Manned orbital stations can serve as laboratories for conduc fundamental research into space technologies. However, self tained automatic space plants will play the leading role here, as t possess quite a few advantages. First, they can ensure the requ level of microaccelerations, which does not exceed the critical va (approximately one-millionth of the ground-level free-fall acc ration). Second, these plants do not require sophisticated energy u Third, they are more cost-effective than manned spacecraft. Furt automatic space plants are capable of conducting technological p cesses on a regular basis, which makes them truly indispensa

The United States, Western Europe and Japan are also busy ta ling these problems. Leading Western European experts estim that by the 2000 AD, space-based production will yield profits the range of 30 to 70 billion dollars annually. A whole arragy space vehicles is being developed for this purpose -- the US is orbit a self-contained 17.4 ton module with a 10.8 kW energy u space crews will be visiting the module on a regular basis. The W Europeans are currently developing the Eureka orbital platform. B vehicles are scheduled to be launched in 1991.

To sum up, one should say that space-based production is qu feasible and that it can yield huge profits. Hundreds of kilogra of semiconductors and other non-organic materials, as well as so 3 kg. of biological preparation can be produced annually. Howeve it will be necessary to construct specialised autoplants to provi the required equipment. Taking into account the experience amass by Soviet researchers, this task can be accomplished by 1994-199 The expenditure will not exceed the profits, likely to be derived fro space-based production in the latter half of the 1990s.

For example, one automatic-mode flight of the Buran reusab space shuttle costs some 80,000,000 dollars. If the shuttle were be equipped with a plant for obtaining expensive medical and bi logical preparations or semiconductors, such a flight would yie a tangible technological and economic effect and justify itself se eral times over. Some people assert that rapidly developing terr strial technology will eventually become a match for space-base production. However, earth based production of semiconductors als requires sizeable investments. And some materials, like large pr tein crystals, monodispersion latexes and large diameter zone-melte germanium ingots, cannot be manufactured in terrestrial condition

-- T.P.S. RAJA

(Source: *The Futurist*, June 1987).

CHEMARENA

L. VENKITESWARAN

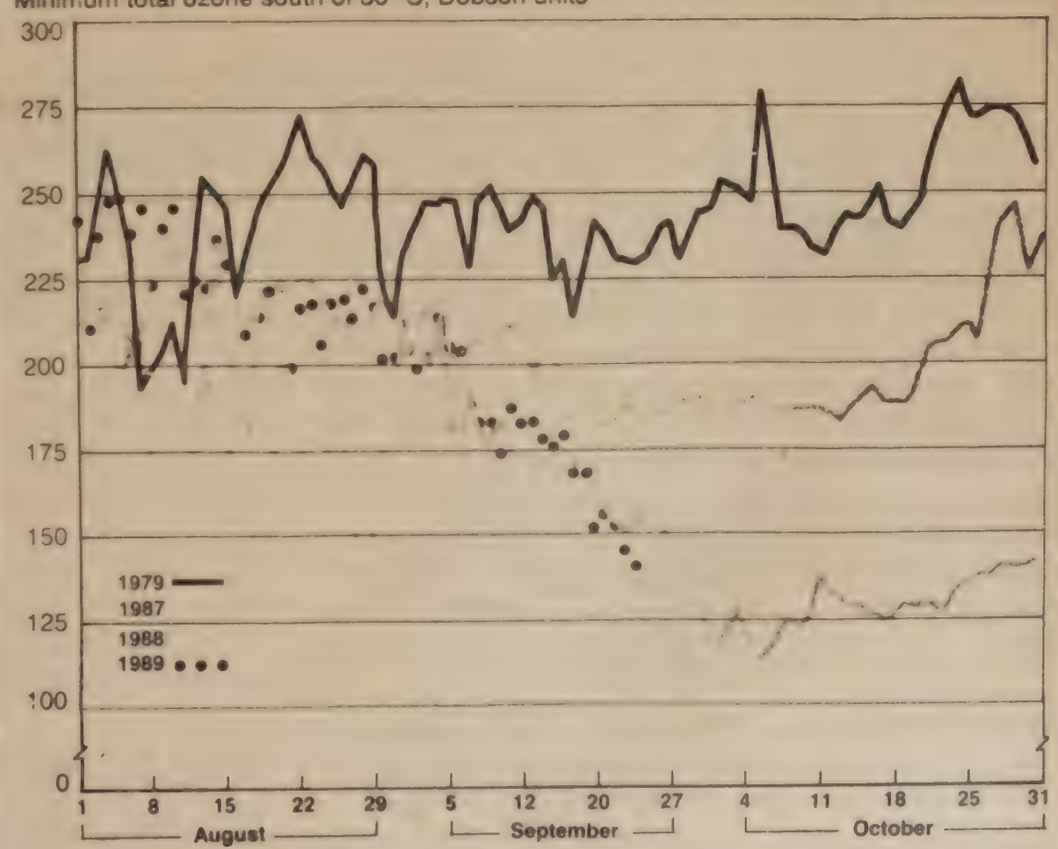
Ozone Depletion

The "Ozone hole" over the South Pole is now well known d the connection between stratospheric chlorine and ozone pletion also established beyond dispute. The last year's stu- s have also borne out ozone depletion but on a much aller scale over the Arctic region as well. The much lower nperature of the Antarctic provides the solid phase for some the projected reactions with chlorine monoxide which trig- r the ozone loss. Although the big drop in ozone levels only for a few worst weeks of the Antarctic winter there a little doubt about the annual loss of ozone in the strat- pheric protection layer around the world. It is anybody's ess as to when the loss will reach levels which could trig- r disastrous consequences to life in the world but chances ould not be taken. The established source of much of this lorine is the CFC's -- chlorofluorocarbons -- released into e atmosphere by aerosols or other sources. There has been general agreement at a world conference in Montreal that FC production and use should be t by 50% by 1998 and on action developing substitutes and also tting down use of CFC's in avoid- ble areas. But more recent data om satellites collected by NASA em to indicate that the depletion ppears to be worsening year after ear as indicated in the graph along- de. Can the steps already agreed on for scheduled scale down in use e too little and is it necessary to ccelerate the phase-down to reach zero level by AD 2000? Perhaps e may hear more on this very soon.

There is also another school which uestions even the use of halohy- rocarbons -- methyl chloroform and arbon tetrachloride -- and demand ban on these. The substitutes for FC's under development are the ydrochlorofluorocarbons HCFC's nd there are questions about these lso. At a meeting in Helsinki a few nonths back the view was that the greed protocol is not adequate to ave the earth's protective ozone ayer and that use of all compounds that carry significant amounts of halogens need to be curbed. There was no diasagreement on the need to eliminate CFC's by 2000 AD. Halons are essential now as fire fighters and the total elimination of CFC's is sure to take decades, when HCFC's may be necessary for an interim period.

At another level is the cost of the present phase out and development of alternatives. There is a proposal for taxing chemicals which contribute to ozone depletion at rates which are proportionate to their "ozone-depleting factor". The tax rates start from $1.37 per lb and go up annual by 45 cents per lb. But this is as a revenue measure and not funded for promoting the substitutes. Even the most ardent supporters of CFC phase out will balk at such a measure which will not apply to production in other countries. But the greater awareness and public preceptions may force the pace of the phaseout.

Antarctic ozone depletion appears to be worsening

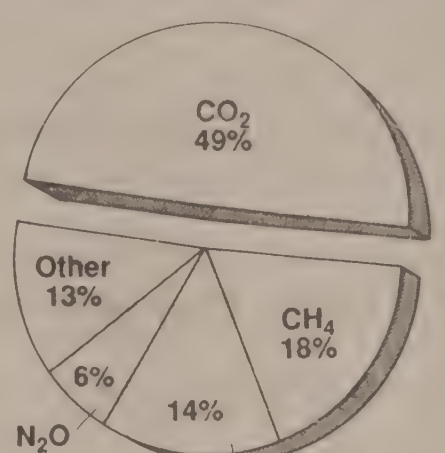


New satellite data from the National Aeronautics & Space Administration show that stratospheric ozone above Antarctica is being destroyed at a rapid rate. The pattern of ozone depletion is very similar to 1987, the worst year to date.

Greenhouse Gases

At another level of serious concern is the prospect of global climate changes due to what are called greenhouse gases in the upperstrata of the atmosphere. An international conference of the Inter Government Panel on Climate Change in Geneva is said to be considering this problem to work ways of devising possible mechanisms for coping with global climate change. "Global climate change could be the dominant foreign policy issue of the next century". There is need to limit emission of the greenhouse gases and the developing countries will have to bear the brunt of this. There are attempts to evolve a concensus paper on the mechanism required and work out a convention or agreement on climate change. The greenhouse gases and their individual share is given in the figure with carbon dioxide being the largest at 49%. The greatest threat is the increasing use of fossil fuels or biomass fuels with China and India in the lead. India cannot certainly forego economic growth and viable alternatives are required for meeting higher energy demands. There is a bill in the U.S. Congress to cut carbon dioxide emissions by 20% by AD 2000. World Resources Institute contends that US is the world's largest contributor of these gases and does not have a policy on CO_2 emissions. There could be serious differences points of view of different countries but the reality may an agreement in the next two decades on the lines of the phaseout agreement. There is a warning that "the issu international equity, technology transfer and economic d opment raised by CFC's will seem like child play comp to those of climate warning". Incidentally there is a r book on "Global Warning: Are we entering the Greenh Century?" by S.H. Schneider published by Sierra Club B USA. The book refers to various co ences including one in India when it said that "global warming is the gre crisis ever faced collectively by hum Scientific disagreement, political rhe and media exaggerations tend to con the public.

CO_2 is major contributor to greenhouse warming



Note: Estimated contributions to greenhouse warming calculated from atmospheric concentrations and radiative properties of gases.
Source: Environmental Protection Agency

The real effects may not be as astrous as predicted. But there is need balancing social and economic va with the new environmental ethic whether ozone layer or acid rain greenhouse gases these are proble which cannot be shoved aside. Planet stewardship may perhaps take shape the coming decades. India has to kee close watch on these developments.

Reuse of Rubber

The old and used tyres are processed for reclaiming the rubber in India. This is a physical disintegration and separation from the fibres and in the reclaimed form and the reuse is limited to a small proportion in the rubber matrix for less critical articles. The "reclaimed" rubber is less than 10% of the total rubber demand. This process is not much used in western countries and the mounting waste tyres and other rubber products have been a serious disposal problem. With increasing concern over the environment and the accumulation of wastes the disposal of rubber has assumed concern and newer methods have been developed. The annual number of discarded tyres is over 250 million in USA -- 2.3 million tonnes and in EEC it is 1.5 million tonnes and over 1 million tonnes of rubber elsewhere.

In a recent conference on Pyrolysis and Gasification a new process of vacuum pyrolysis has been presented by scientists of the Laval University of Canada. Pilot plant trials are completed and the process recovers the initial compounds which constitute the tyre (*Plastics & Rubber Intl.*, August 1989). The tyres are made up of a complex mix of constituents besides rubber which is already vulcanised. The vacuum pyrolysis enables recovery of the oil content, carbon black and steel (if steel belted). The results are promising and a plant to handle 10,000 tpa is expected in the near future. T recovery of values are much more than by mere reclaimi or pyrolysis. Present process uses whole tyres as shreddi is expensive. The quality of carbon black recovered is imp tant and vacuum pyrolysis alone ensures its quality besi recovery of the compounded and pyrolysed oil. Vacu pyrolysis also avoids the secondary reactions of the produc The reactor design is critical and continuous feeding un vacuum with separation of steel, carbon black and conde sation of the oil are achieved in a saleable quality. The has a higher heating value and specific gravity of 0.95 a a pour point of 6°C and can be used as a heating oil. T oil contains some quantities of aromatics. Carbon black produced at 550°C and 43 Kpa. The overall balance of mat ial and values recoverable are as under:

Oil - 5.5% regular grade	18 $/bbl
Carbon black - 25% regular grade	100 $/ton
Carbon black improved grade	485 $/ton
Steel- 9%	90 $/ton
Fibre/Kevlar - 5%	2 $/ton
Gas - 6%	used for make up heat.

The profitability is claimed to be good on a 20,000 t recovery plant under Canadian conditions.

EXPORT TARGET FOR DYES

Raw materials scenario assessed

In view of the ambitious targets proposed for dye exports from the country, the Dyestuff Manufacturers Association (DMAI) had organised a panel discussion to assess the raw materials availability scenario in the years to come. The meeting, held in Bombay on January 5, 1990, was attended by leading manufacturers/exporters of the dyestuff industry. The panel members included, Mr. Sharad Kothari — Managing Director, Jaysynth Dye Chem Ltd., Dr. B.B. Khare — Director (Commercial), Hindustan Organic Chemicals Ltd., Mr. B. Rajagopal — General Manager (Marketing), The Atul Products Ltd., Mr. D. Bhattacharji — Chief Manager (Chemical Business Group), Indian Petrochemicals Corporation Ltd., and Mr. J.M. Mauskar, Executive Director, CHEMEXCIL. The President of DMAI, Mr. Anil Mehta conducted the panel discussion.

Welcoming the gathering Mr. Bakul Patel, former President DMAI, noted that the assessment of raw material availability assumed importance in view of the problems experienced over the past year. With India's position as a major exporter of dyes getting more secure, the need for a realistic assessment of raw material availability became urgent. Mr. Patel noted that the panel with representatives from both the dyestuff industry as also leading suppliers provided an excellent forum for initiating such a discussion.

Growth in real value terms

Stressing the need for growth in terms of both tonnage and value registration per unit, Mr. Mauskar cautioned that an achievement of say Rs. 2,500 crores would be considerably diluted, if the rupee-foreign currency parity got worse. Lamenting the unhealthy competition between the manufacturers, Mr. Mauskar noted that atleast a 20% increase in value addition was possible if such undercutting in prices were avoided.

He mooted the formation of a representative body, such as the Japanese MITI, to enable exporters to get maximum realisation for their exports. Such an association could also help in regular purchases of raw materials and ensure equitable supply to users, felt Mr. Kothari.

Increasing competition

The panel members were in agreement to the fact that while India's dyestuff exports sounded impressive in isolation, in reality it represented a little over 5% of the world trade. Given a suitable exim policy and adequate availability of raw materials a target of about 20% of the world trade should be realistic.

With environmental pressures forcing numerous countries to opt for imports of dyes or their intermediates India should seize the opportunity and show improved performance. The recent developments in Eastern Europe with its concomittant consumerism should present an excellent opportunity to Indian exporters. Other countries notably China, Korea, Taiwan and Indonesia, were also making rapid progress and could easily end up seizing the moment if Indian exporters failed to do so. "India has gained and lost grounds very quickly", noted Mr. Kothari while calling for exporters to sustain the achievements made over the past two years.

Capacity constraints

Mr. B. Rajagopal, General Manager Marketing, Atul Products Ltd., emphasised the need for establishing more capacities in dyestuff production. He noted that the current capacity in the country produced about 65,000 tonnes of dyes and intermediates valued at approximately Rs. 1,500 crores. To meet an export target of Rs. 2,000 crores from this capacity, was unrealistic. Some members of the panel, however noted that the industry would be capable of producing atleast 50% more than that at present, even with the ing capacity.

Ethylene oxide shortage to pe

Mr. D. Bhattacharji, Chief Ma Indian Petrochemicals Ltd., (warned that the current shortages ylene oxide would persist in the future. Ethylene oxide (EO) finds the manufacture of vinyl sulphone about 5% of the total availability into this segment. With the burge export demand, EO is proving to increasing short supply.

To meet the increasing demand has stepped up its capacity to 1 tonnes, but due to technical const has been unable to produce co ously at this rate. With about 1 tonnes available from NOCIL, EO lability is anticipated at around 1 tonnes leaving a gap of about tonnes between supply and dema

With IPCL's gas cracker goin stream (some time in March) an 5,000 tonnes (later to be expand 10,000 tonnes) are expected to be able. The long term scenario thus EO to be in short supply atleast unt Reliance and SM Dyechem plants latter based on alcohol) come on st To tide over such a situation Kothari urged that EO be diverted other uses such as for glycol ethers dyestuff production.

HOC geared to meet challenge

Dr. B.G. Khare, Director (Com cial), Hindustan Organic Chem Ltd., arguably the single most impo supplier to the dyestuff ind sounded a note of optimism rega raw material availability. He noted barring the preceding few months has been largely able to meet requirements of the industry be it fo export or domestic markets.

Outlining HOC's expansion/debo necking plans for the next few years Khare noted (a) The ready availab of nitrobenzene from January this

with an additional nitric acid plant coming up in a couple of years, HOC will be surplus in nitric acid.

(b) Aniline availability has also improved and further capacity of 9,000 tonnes is expected to be added in about two years.

(c) Acetanilide production is likely to be doubled from 4000 tonnes to 8000 tonnes within the next year.

(d) PNCB shortage is likely to lessen with renewal of supplies of monochloro benzene from Durgapur Chemicals Ltd. To meet the demand for PNCB in the short run, about 125 tonnes of the material has been imported and another 500 tonnes are being planned to be imported.

(e) A 18,000 tonne facility for nitrochloro benzenes costing Rs. 32 crores is also on the cards. The project is currently awaiting government approval.

(f) A proposal to triple capacity of nitrotoluenes in the long run.

(g) A facility to produce acetic anhydride from alcohol.

(h) A new formaldehyde plant of 100 tpd is expected to go on stream in another 12 months.

With the above projects in line, Dr. Khare felt that HOC was geared to meet the demands of the dyestuff industry.

The panel discussion thus ended on a note at cautious optimism while calling for an organised distribution of items in short supply, ensuring fewer plant shut-downs.

SUPERCONDUCTIVITY: SUBJECT FOR ALL SEASONS

Superconductivity has been one area which has emphasised the need for improving the research infrastructure in the country so that the capacity of our scientists to absorb the developments occurring the world over as well as to work on innovative ideas is vastly increased, said Prof. C.N.R. Rao, in his opening remarks at the inauguration of India's First International Conference on Superconductivity which began at Bangalore on January 10.

Prof. Rao, who is the Chairman of the National Organising Committee of the Conference, said superconductivity has become the subject for all seasons and for people from different disciplines. The challenges that the new field of high temperature superconductivity has posed have been such that the scientists no longer recognise border lines and it, like no other subject, has brought together physical scientists and engineers, he said. At a time when it was being felt that there was nothing left for solid state scientists to do, contributions have been made in the field which have become worthy enough for common people and even politicians to talk about, he added. "The excitement of the last three years has been fantastic", he remarked.

The five-day conference has brought together physicists, chemists, ceramists and engineers numbering over 450 from over 12 countries. Welcoming the delegates earlier Prof. S.K. Joshi, Director of the National Physical Laboratory and Chairman of the Programme Committee for the Conference, said that the participation has been beyond the expectations of the organisers.

Some leading research workers in the field from different parts of the world also made some remarks about superconductivity programmes in their respective countries at the inaugural ceremony which, it must be remarked, was without the customary, but unnecessary, winding speeches of some luminary public figure and the like.

Prof. Bianconi, of the Universita la Sapienza, Rome, said that improvement of superconducting materials has been recognised as the key issue today though after 1987 much better crystals have been made and much better experimental results have been obtained. He informed that the Italian progra was linked to the European pr under the European Economic munity.

Prof. M. Cardona of the Max-P Institute at Stuttgart observed tha gress in the area of superconduc had been possible due to the ope with which research is being carrie in his country. "Secrecy has la been avoided both in the industry research laboratories with due rec tion to issues of proprietory nature said. Prof. Cardona has come to with a high temperature supercondu ity demonstration kit which, as h it, has kindled interest in the p "from the plains of his country t heights of Andes mountains".

Efforts in Japan

Dr. K. Kitazawa of the Universi Tokyo describing briefly the effo Japan said that superconductivity set off a severe competition amon various ministries of the Governm notably the Ministry of Education Ministry of International Trade Industry (MITI) and the Ministr Transport.

According to him, a consortiu nearly 100 companies has been se under the recommendation of D Tanaka, one of the key figures in J in high temperature superconducti Dr. Tanaka also heads a centre ca the International Superconducti Technology Centre (ISTEC) set u interface with these companies on developments in the field.

Dr. Pravin Choudhury of I Research Division, Yorktown Heig New York, said that the subjec superconductivity has raised deep i llectual questions and at the same t promises enormous industrial appl tions. He remarked that between Ja and the US more than half a billion lars had been spent during the last on superconductivity research. Prof Raveau of the University of Ca

rance, said that the French research gency, CNRS had started quite early o manage the superconductivity pro-ramme in France and over 400 projects ad been initiated in association with ompanies.

ROLE OF COPPER SHEETS

"I am not a religious person but per-aps God made copper for us to have ot only good conductors but even uperconductors (of electricity)" emarked Prof. C.N.R. Rao in response o a question from the audience whether s a solid state chemist Prof. Rao could nderstand why we are struck with copper in all the high temperature superconducting materials discovered so far. Prof. Rao was delivering a plenary talk on the topic of "Superconducting Cuprates and Nickelates". Right from the first high temperature superconductor at 30°K (-243°C) found by Drs. J.G. Bednorz and K.A. Mueller in a lanthanum-based oxide to the highest temperature thallium-based oxide superconductor at 162°K all of them seem to need the presence of copper oxide in their structure. That is, they are all cuprates. Structurally all these belong to the broad class of materials called perovskite oxides where sheets of copper oxide sandwich between them atomic sites of other atoms present in the material to yield a quasi-two dimensional character to the unit cell of the crystal structure of the material.

Role of copper sheets

The role of these copper sheets is considered very crucial in the phenomenon of high temperature superconductivity. The lanthanum compounds and the so-called 123 compounds based on yttrium oxide, in fact, have additional chains of copper oxide as well. Initially it was thought that the presence of both sheets and chains was essential to have high temperature superconductors. However, the subsequent discoveries of thallium-based and bismuth-based oxide compounds have shown that it is the copper oxide planes which are dominantly responsible for the phenomenon because these latter materials have no chains. It has also been found that clever engineering of oxide materials show that they have more number of copper oxide layers stacked in a unit cell (upto four) result in higher transition temperatures.

Charge transfer

The present understanding, as was outlined by Dr. B. Batlogg of the IBM Research Labs in his inaugural invited talk, is that high temperature superconductivity is probably due to charge transfer in and out of these active copper oxide layers. The mixed valency property of copper is regarded very important in this charge transfer mechanism.

DU PONT PLAN

EI Du Pont de Nemours, one of the world's largest chemical manufacturers, is planning to make the Asia Pacific region a major production base. In the '90s, Du Pont plants to invest about one billion dollars in the area, including several manufacturing joint ventures in India. Right now, Du Pont is seeking permission to set up a Nylon 6,6 plant in collaboration with the Thapars and Economic Development Corporation of Goa. Simultaneously, it is setting up facilities at Singapore to make adipic acid — a raw material for Nylon 6,6. The strategy is to integrate worldscale intermediate plants with polymer capacities to ensure a strong presence in the polymer markets of Asia. Yet, these projects may make sense to India only if the Government approves the Nylon 6,6 project against which there is tough opposition from the local nylon producers lobby.

CORRIGENDUM

In Chemical Weekly issue dated 9.1.1990, page 102 the name of the advertiser was inadvertantly printed as Intermediate Exim. The correct name should read Intertrade Exim. The error is regretted.

-- Editor

RAISING FERTILISER CAPACITY

Government holding up proposals worth over Rs. 1,720 crores

The Union government is withholding consent to proposals worth over Rs. 1,720 crores for increasing the existing capacity of various fertiliser units in the country. Most of the proposals have been lying with the government for more than a year. In every case, the government's response is that either the proposal is "at an advanced stage of consideration" or is under examination.

The delay in taking a final decision will eventually raise the final cost of raising the production capacity and make the units' operations less viable, industry sources say. Barring one, all the proposals gathering dust in government cupboards are for modernisation, technological upgradation, rehabilitation and replacement of old plants and debottlenecking of units.

Only one proposal is for doubling existing capacity. Yet, the government has taken considerable time in deciding on that. Interestingly, all the proposals have come from fertiliser units belonging either to the public sector or the co-operative sector. Apparently, the sponsorship and administrative support of the fertiliser department to these units have not been of much avail.

In fact, no proposal from the private sector fertiliser industry for raising capacity is pending with the government. According to information available with the fertiliser department, the proposal from Hindustan Fertiliser Corporation (HFC) for revamping their four units — two at Namrup and one each at Durgapur and Barauni — is lying with the government since April 1988.

The revamping cost, estimated at Rs. 486.39 crores, aims to achieve 100 per cent capacity utilisation for these units compared to their existing capacity use level of 38 per cent. The Fertiliser Corporation of India (FCI) has two proposals for modernising its plants at Gorakhpur and Ramagundam. Both the proposals are at an 'advanced stage of consideration' by the government. The one at Gorakhpur is to cost the FCI Rs. 66.65 crores for revamping and upgrading the plant's technology. This will raise the unit's production of urea from the present 182,780 tonnes per annum to 2,15,520 tonnes per annum. The proposal which will also aim at reducing pollution levels and energy consumption, was submitted in January 1986.

The proposal for rehabilitating and installing captive power units at the Ramagundam unit was submitted in September 1988. This would have revised its urea production from the present 1.6 lakh tonnes to 2.97 lakh tonnes per annum. The Cochin-based Fertilisers and Chemicals Travancore Limited (FACT) submitted its proposal in January 1989 for replacing its existing ammonia plant of 340-tonne per day capacity at Udyogamandal with a 900-tonne per day capacity plant, at an estimated cost of Rs. 340.14 crores.

Its proposal for debottlenecking or retrofitting of phosphoric acid plant and NP plant and balancing of sulphuric acid plant capacity at its phosphatic plant at Cochin was submitted in August 1989. The proposal is estimated to cost Rs. 117.65 crores and will raise the production of complex fertiliser from 460,000 tonnes to 585,000 tonnes per annum.

The Indian Farmers Fertilisers Co-operative Limited (IFFCO) submitted its proposal to double the capacity of its Aonla plant in February 1988. Estimated to cost around Rs. 607.4 crores, the proposal is aimed at raising the urea production capacity from 2,200 tonnes per day to 4,400 tonnes per day.

IFFCO's other proposal for revamping its units at Phulpur, Kandla and Kallol to maintain the production level of 19.36 lakh tonnes of fertilisers per annum for another 10-15 years was received in September 1986 and is under implementation. The propo costing over Rs. 114.41 crores, is aimed at imposing strict pollution trol and safety standards.

The country's total fertiliser proc tion in 1988-89 is estimated at 8 lakh tonnes. In April-October 1989, tiliser production is estimated at 4 lakh tonnes, against 50.12 lakh ton in the same period of 1988.

PLASTIC LENSES PROJECT I AP

A group of non-resident Indians setting up a state-of-the-art plant Andhra Pradesh to manufacture plas lenses used in spectacles. The pla which has been approved by the Indi Government is being set up in Med with a manufacturing capacity of 2 million pairs of plastic lenses p annum. The project has been approv as a 100% export-oriented unit and w enjoy a tax-holiday for five yea During the first eight years of operatio the entire export income will be tax fre

Resin lenses have virtually replace glass lenses in spectacles as they a lighter to wear and easier to maintai The product thus has a large mark with a labor-intensive manufacturin process. Because of the high labou cost, manufacture is being phased o in the United States and Europe is n adding any new capacity. As a resul the manufacturers estimate that the ga between demand and supply in Europ and the US in 1993 will be about 10 million pairs.

Mr. K.V. Rao, one of the member of Techtan Ltd., the promoting com pany, who has returned to India to se up the project, said that the project cos would be around Rs. 1,830 lakhs wit an equity of Rs. 675 lakhs. Techtan i putting up Rs. 320 lakhs and Rs. 35 lakhs is to be raised through a public issue in India. About Rs. 1,170 lakhs i being lent by Indian banks at a conces sional rate for exporters at 11.2%. The participating banks are the Bank o India Mutual Fund, the Canara Bank and the Grindlays Investment Fund.

Mysore Petro setting up EOU

Mysore Petrochemicals Ltd. is promoting a 100 per cent EOU to manufacture 45,000 tonnes per year of phthalic anhydride in Taloja in Maharashtra costing about Rs. 62 crores.

Had it not been an EOU, the project cost for the same plant would have been about Rs. 130 crores, according to Mr. S.S. Dhanuka, Managing Director of Mysore Petrochemicals, which is promoting the EOU called IG Petrochemicals Ltd. An EOU is entitled not only for duty-free import of raw materials but capital equipment, including those available indigenously, thereby enabling it to cut costs. After five years of production, the EOU has the option of becoming a domestic unit by paying duty on written down value.

Lurgi GmbH of West Germany will be a financial and technical partner, holding about 15 per cent of equity. It has also entered into a 100 per cent buy-back arrangement with IG Petrochemicals. All necessary Government clearances have been obtained by the company. The Indian demand for phthalic anhydride is only about 50,000 tonnes. IG Petro, as per rules, can sell 25 per cent of its produce in the domestic tariff area. The other Indian producers of phthalic anhydride are Tirumalai 20,000 tonnes, Mysore Petro 12,000 tonnes, Herdillia 7,000 tonnes, Indian Dyestuffs and Ambuja Petrochemicals 9,000 tonnes each.

Another attractive spin-off of the project is a 2,400 tonne plant to produce maleic anhydride from the waste water available from IG Petro's phthalic anhydride plant. The technology chosen for the recovery of maleic anhydride is Bayer AG-Lurgi process licensed through Lurgi. The basic engineering and imported equipment are also supplied by Lurgi.

The existing phthalic anhydride plant of Mysore Petro at Raichur in Karnataka is generating about 12,800 tonnes of waste water. This, added to the waste water generated at the EOU in Taloja, will total almost 60,000 tonnes, making the maleic recovery plant a very sound project. Mysore Petro will have a cost advantage of about Rs. 15 a kg. over other manufacturers who produce maleic from benzene, butane etc. which accounts for 68 per cent of the cost. As per rules, there is no duty payable on waste water.

Recovery of maleic will also contribute to considerable savings in phthalic anhydride operations as it eliminates an expensive effluent treatment unit. What is more, the demineralised water will be recycled to the phthalic plant. Being adjacent to IG Petro's plant at Taloja, the maleic project will benefit from cost savings in terms of transport and utilities like excess steam, power and cooling water available with IG Petro at reasonable cost.

Maleic anhydride is used in the manufacture of polyester resins with wide applications from furniture to radar domes, alkyd resins and paints, varnishes, ink and adhesives, petroleum additives, rubber chemicals, photographic chemicals, fungicides and pesticides. It is also a raw material in the production of fumaric acid, succinic acid, aspartic acid and tartaric acid.

The estimated cost of the maleic project, Rs. 12.63 crores, will be financed by a rights issue of 14 per cent partly convertible debentures aggregating Rs. 12.93 crores. This offer to shareholders will be made later this month. The break-even capacity is around 55 per cent of the installed capacity. This diversification is expected to generate an additional turnover of Rs. 6 crores on implementation.

NEW FERTILISER UNIT IN RAJASTHAN PLANNED

A new phosphatic fertiliser plant costing Rs. 220 crores is planned near tor in Rajasthan. The Rash Chemicals and Fertilisers is inter in the project and so are others.

The proposed plant is an una pated by-product of the discove high zinc lead ores at Rampur Agucha. These ores are going t smelted into metal by Hindustan Ltd. at a new plant at Chanderiya Chittor. The ores are sulphurous will yield 150,000 tonnes of sulph acid per year as a by-product. Th more than enough to sustain a big p phatic fertiliser complex.

Rock phosphate is available in pl from the nearby Jhamarkotra mine can be converted into phosphoric by treating it with sulphuric acid. N the phosphoric acid will be combi with ammonia (brought in by rail tank wagons) to form diammon phosphate, one of the highest value tilisers used in India.

The new Chanderiya smelter will expanded in due course and co enable the fertiliser complex to expa too. This will subsitute imports of ph phoric acid and sulphur which are on rise. Given the shortage of resources the Eighth Plan, funds for new fertili projects will not be easy to come But in this case the advantages are great that it could rate a high prior It will optimise the fuse of rock ph phate and sulphurous ores close to place of production. Most diammoni phosphate plants today are shore-ba (as they import sulphur or phospho acid) and an inland plant in Rajasth would save on transport costs. Hin stan Zinc Ltd. is also examining the p sibility of producing sulphuric acid fr the tailings of its old smelter at Deb These tailings contain iron sulphide has not been economic so far to reco sulphuric acid from these. But sinc fertiliser complex gets a Governm subsidy, this sulphur recovery co prove economic as part of a fertili complex.

PHTHA PRICES:

New policy being evolved

he Government is evolving a long-
n policy for naphtha prices and tariff
tection for chemical aromatics.

High level inter-ministerial meeting,
ch considered the issue, has recom-
nded that the policy would com-
nce from 1992.

The long-term recommendations
de by the Bureau of Industrial Costs
Prices (BICP) in its report on aro-
tics will form the basis of the new
icy.

The prospective import duty structure
the long-term policy would be CIF
ce plus 25 per cent for naphtha, 40
cent for benzene and toluene and 55
cent for xylenes.

The meeting also accepted in princi-
the BICP recommendation about substitution of benzene with fuel oil in steel plants.

In its report submitted to the government in December 1988, BICP had recommended that the policy of administered pricing on both naphtha and fuel oil may continue but the domestic selling prices of these inputs should be made equivalent to CIF price with 25 per cent import duty to reflect the premium on foreign exchange.

The report had said that as the international prices of crude and aromatics stabilise, the short-term tariff policy should be substituted with the long-term import policy and duties. The prices of aromatics in the long run will structurally align in terms of relative prices of the petro-based products vis-a-vis naphtha price and crude, namely $ 15 and $ 18 per barrel.

For the $ 15 a barrel price alternative, BICP had recommended import duty of 25 per cent for naphtha, 55 per cent for benzene and toluene and 70 per cent for xylenes for actual users. As regards the $ 18 per barrel price alternative, BICP had recommended import duty of 25 per cent for naphtha, 40 per cent for benzene and toluene and 55 per cent for xylenes.

The report had said that the tariff policy in respect of prices of naphtha and fuel oil supplied to steel plants also needs to be considered in the short run since the additional production of aromatics will save substantial foreign exchange.

The production of aromatics in the steel plants was much lower than the potential availability and these were being utilised as energy source by the steel plants. In 1987-88, production of aromatics from all the steel plants was only 16.7 tons.

Government awaits panel report to fix sale price of paraxylene

The Union Finance Ministry has asked the cost account branch (CAB) under the department of expenditure, to study the actual cost of indigenously produced paraxylene. The Government is likely to fix a fair selling price for it on the basis of the CAB report, which is expected to be submitted shortly. The CAB is understood to be going into details of cost of production of paraxylene by all the three local producers viz, IPCL, Reliance Industries and Bongaigaon Refineries.

The Bureau of Industrial Costs and Prices (BICP) had submitted a report to the government in December 1988 based on the cost of paraxylene in the production of DMT. At that time, IPCL was the lone indigenous producer of paraxylene. Now, the CAB is carrying out a cost study for all the three plants. The authorities appear to be keen on stopping any further imports of paraxylene in view of the adequate availability from indigenous sources on the one hand, and the critical foreign exchange position on the other hand. With a view to curb unnecessary imports and save exchange, the government has already canalised it through IPCL.

Paraxylene is the basic raw material for the production of DMT and PTA. The country has been a net importer of paraxylene all these years and the annual imports ranged between 50,000 to 60,000 tonnes to meet the sole requirement of Bombay Dyeing and partial needs of IPCL and Bongaigon Refineries, all the three DMT producers.

The situation appears to have improved with the paraxylene plant of Reliance Industries coming into production. The company is understood to have offered 5,000 tonnes of paraxylene per month to the canalising agency after meeting its captive consumption production of PTA.

The position is expected to b better with the de-bottlenecking IPCL plant very shortly. Th expected to make India a net ex of paraxylene rather than a net im which it has been so far.

OBITUARY

G.C. SUTARIA

We regret to announce the s demise of Mr. G.C. Sutar National Fluorine Corpo (Bombay), on 25th Dec. 198 Sutaria pioneered the productio development of fluorine che and had established production ities at Bombay and Vapi. N.F India's foremost producer of ine chemicals. Mr. Sutaria's so Sanjay Sutaria has now taken the business.

30 proposals await PIB clearance

tleast 30 major proposals have been iting the Public Investment Board's rance for the past three months. The rd has not met since the announce- t of the general elections and the nge in the government. What is se, the board is not likely to meet another month due to the top offi- level changes in the finance and the r ministries.

he number of projects lined up re the board is likely to touch a gering figure of 60 and even more e ensuing period. Officials point out it will take more than a month and ries of prolonged board meetings to r the projects. The proposals in the eline include power, coal, fertilisers, pping and ONGC projects. There are mber of small projects awaiting the ision of the cost estimates. The con- ned ministries are extremely upset as delay will result in higher project ts.

Besides, the departments and minis- s whose proposals are stuck at the B level are worried that they will not able to include some of their projects the 1990-91 plan if the clearance is given immediately. These ministries ve been approaching the Finance nistry for the PIB meeting at the ear- st.

It is stated that the Finance Ministry joyed full powers to clear proposals ring the election period. However, sing a change in the government, the nior official did not want to take an due responsibility for giving a nod to rtain controversial projects. So is the se even after the new government has me into power. Due to drastic changes the key bureaucratic posts, PIB has t been meeting. The Finance Minis- is now taking initiative to convene e board meeting.

The other projects, especially in the re sector including coal and power ill mean their exclusion from the next year's plan. In a bid to cut commission- ing time on the basis of the PIB approval, the coal and power project authorities take advance action. This process, too, will be delayed.

In addition to the PIB delay, the Cen- tral ministries find that they will have to prepare all over again proposals approved by the previous ministers before sending them to the new cabinet for approval. The process of inviting inter-ministerial comments will have to be started all over again. The projects in the pipeline will have to be redrafted again to reflect the new government's ideology.

DUTY-FREE REPLENISHMENT LICENCE SCHEME URGED

The Federation of Indian Export Organisations (FIEO) has strongly pleaded for reintroduction of the duty-free Replenishment licence scheme on the ground that input-output norms under the advance licensing scheme have expanded to cover more than 500 products.

The duty-free Replenishment licence scheme was withdrawn from April 1, 1988, which adversely affected small-scale exporters. It was first introduced in 1980-81.

The FIEO President, Mr. Ramu S. Deora, said in a statement recently that according to this scheme, an exporter had the facility of obtaining duty-free Replenishment licence on the basis of exports already made by him under the advance licensing scheme.

On the other hand, an exporter obtains an advance licence on the basis of an export order with the commitment of fulfilling an export obligation. Mr. Deora said that the duty-free Replenishment scheme had a number of advantages.

Caprolactam shortage

Once again the nylon spinners are facing a severe shortage of caprolactam, their basic raw material. In the past two years, there have been several occasions when the industry had to cut down the production of nylon yarn owing to caprolactam shortage. Consequently, the art silk weavers in Surat and other places had to live with shortages and high prices of nylon yarn. It is indeed unfortunate that at a time when there is a growing domestic and export demand for nylon yarn, the spinners are forced to cut down their production for want of caprolactam. This shows the lack of proper planning on the part of the concerned authorities.

The prestigious multi-crore ammonium sulphate caprolactam plant of the public sector Fertilisers and Chemicals Travancore (FACT) to produce 50,000 tonnes of material per annum was to have been commissioned in September last year. Consequently, the government which is facing a foreign exchange crunch, has been permitting caprolactam imports only in small lots. Thus the total imports allowed so far have amounted to only about 60 per cent of the actual imports last year with no indication about the allocation of further foreign exchange. The sole producer of caprolactam in the country, the Gujarat State Fertiliser Corporation (GSFC) has been able to supply hardly 20 per cent of the total requirement of the material estimated at 75,000 tonnes.

Now the manufacturers of nylon filament yarn are once again considering production cuts till the supply position of caprolactam improves. The nylon weavers have expressed their fear that if there is a production cut by spinners, the already prevailing unofficial premia on different deniers of nylon yarn will shoot up further as shortages aggravate. Since the caprolactam plant of FACT has still not gone on stream, there is an imperative need to arrange for immediate import of the material.

CUSTOMS DUTY FOR PLASTICS REVISED

The rates of customs duty for major plastic raw materials have been revised with effect from January 5, 1990. According to an official release on January 8, the customs duty on polypropylene and copolymers has been revised from 20 per cent ad valorem to Rs. 7000 per tonne. On high density polyethylene moulding powder and granules, the duty has been revised from 20 per cent to Rs. 6,400 per tonne. On low density polyethylene and copolymers of low density polyethylene other than LDPE based sheathing compound and insulating compound, the duty will now be Rs. 6,200 per tonne against Rs. 2,000 per tonne earlier. O vinyl chloride, other than past and battery grade, the duty ha revised from Rs. 1,000 per to Rs. 2,000 per tonne and on polys including copolymer of styrene f per cent ad valorem to Rs. 17,5 tonne.

By another notification issued same day, auxiliary duty on cust polyvinyl chloride, other than grade and battery grade has been from Rs. 3,000 per tonne to Rs. Auxiliary duty of customs on styrene, (including copolymers polypropylene, (including copoly has also been raised from 30 pe to 45 per cent ad valorem.

SPOT CRUDE PRICES SHO

The average spot price of the C isation of Petroleum Exporting C tries' (OPEC) basket of crude oil from $ 14.38 per barrel in 1988 17.31 per barrel last year. The w Middle East Economic Survey (M said the spot prices prevailing or uary 3 soared to about $ 21 a barre OPEC basket — with a "minimum rence price" of $ 18 a barrel — prises seven sorts of crudes. Dema OPEC crude "is evidently outpaci forecasts due to higher-than-exp demand and lower-than-expected OPEC supply", MEES said.

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Policy on aromatics

the demand for aromatics projected he Committee for Perspective Plan- of the Petrochemical Industry PPI) materialises, the country is in some trouble. Against a demand mate of 353,000 tonnes of benzene 989-90, domestic capacity availa- ty is 236,000 tonnes. By the year 0 A.D., demand is expected to be re than 858,000 tonnes. In the case paraxylene, against a capacity avai- lity of 142,600 tonnes, demand is ected to increase to around 255,000 nes by the end of the Eighth Plan ich would further go up to around ,000 tonnes by the end of the cen- y.

Going by the prices likely to prevail he international market, even if the ntry were to fully utilise its existing acity, it would spend a sum of und $ 89 million by the end of the hth Plan in importing benzene and axylene. By 2000 A.D., the import on these two accounts would ount to more than $ 400 million pro- led international prices do not rise t the saving grace is that these mand projections are unrealistic. A ssessment of the demand model by Bureau of Industrial Costs and ces (BICP) yielded a substantially ver rate of growth of demand than the per cent per annum projected by the PPI. Therefore, the gap between mestic availability and demand, hich needs to be met by imports, is uch narrower.

A bottleneck in increasing domestic oduction in the short-term is the mis- ilis tion of benzene and toluene, hich are byproducts from coke ovens the steel plants. Steel plants find it ore economic to use these byproducts energy sources rather than recover em and sell the same to the petro- emical industry. That would require me investment in the benzol recov- y plants and the coke oven batteries steel plants and supply of fuel oil to em at international prices. For the shortages that may arise from time to time, aromatics will have to be imported.

It is important to think of a rational import policy and a duty structure that would not only protect domestic industry but also ensure that domestic users of aromatics are not put in a difficult position compared with those abroad. In this context, BICP's recommendations for reducing the duties on imported aromatics are welcome.

It is also necessary to remove some of the aromatics from the canalised list. But they need not be put on the OGL list for all and sundry to import as suggested by BICP. That would give scope for speculation, especially in the light of the unsteady conditions prevailing in the international market. An actual user clause in OGL is necessary and will help ensure that domestic producers pass on the benefits of lower duties to the downstream units.

METALS GLUT

Prices of base metals are expected to slide down in 1990 from the levels they had generally maintained last year. The current forecast is that production will rise and demand decline to a considerable extent in the current year. The average price of copper which was 125 US cents a pound in 1989, is anticipated to come down to 95 US cents in 1990 (24 per cent fall). Aluminium is forecast to lose 16.1 cents at 71.5 cents, tin to shed 124 cents at 384 cents, zinc down by 18.4 cents at 57 cents, lead to lose three cents at 27.2 cents and nickel nearly 150 to 200 cents at 350/400 cents. The expected price fall in copper in 1990 is attributed to the build up of surplus of 200,000 tonnes of refined copper which may exceed global demand.

It is estimated that with better utilisation of enlarged capacity the mine output would be up by 4.2 per cent and refined production by 3.3 per cent.

On the other hand copper consumption growth rate is forecast to decline in 1990. Similarly the growth in the consumption of aluminium is expected to be sluggish, particularly in industrialised countries, since the key sector in need of the metals, such as automotive and construction are facing a downturn in their operations.

A global market study on metals says that aluminium prices will continue to fall unless the excess supplies are reduced considerably. Consumption may be around 615,000 tonnes in 1990 against 650,000 tonnes last year.

SREE KRISHNA PHARMA

Sree Krishna Pharmaceuticals (P) Ltd., the only SSI unit manufacturing folic acid in the country, has decided to embark upon a diversification programme, at a cost of over Rs. 1 crore, into formulations.

Addressing newsmen in Hyderabad recently, Dr. V.V. Subba Reddy, Chairman of the company, and Mr. P.B. Sattur, Director, stated the company is one of the pioneers engaged in the manufacture of bulk drugs since 1975 and over the years had grown to touch an annual production of 700 tonnes of paracetamol, used by a number of top companies in the country.

After achieving success in marketing paracetamol and folic acid with annual turnovers running into Rs. 4 crores and Rs. 2 crores respectively for each of the products, the diversification is now being launched.

It is proposed to manufacture analgesics, antiinflammatory, heamatinics, paediatric, antidiabetic and cardiovascular ranges, Dr. Reddy said. A few trial enquiries on export of folic acid are under consideration and hopefully export market will open up for folic acid very soon, Dr. Reddy observed.

Chemistry Day

For the second year in succession the, Rotary Club of Ambernath jointly with Marathi Vigyan Parishad, observed "Chemistry Day" on December 2, 1989 at Rotary Bhavan.

About five hundred SSC students and teachers from P.M.M. Innerwheel School, Kansai School and Mahatma Gandhi School attended the programme.

Rtn. Dr. V.M. Vaidya who conducted the programme, explained to the audience that we observe Chemistry Day so that people get rid of their misgivings about chemistry and good students are attracted towards chemistry. The faculty came from an Education Institute, a Consulting firm, R & D Centre and a Production Unit.

The first speaker was Shri S. Jawadekar, who is a noted Sci-Fi, writer in Marathi, spoke on the subject of history of chemistry. He made his talk very amusing by telling very interesting stories and facts. He mentioned that some people had taken patents on making "Sherbats' by using hydrochloric acid.

Prof. Rajadhyax from Department of Chemical Technology spoke on catalysis. He made the subject very lively. He explained at length the catalytic synthesis of Ammonia.

He said that there are challenges in chemistry, like nobody has improved on the ammonia synthesis since 1913 and if bright students take to chemistry only they can accept such challenges.

Dr. S.G. Kane, who is Research & Development Manager in NOCIL, Thane, explained how one has to think about the 'Arithmetic' of requirement, (demand), planning and production. He spoke on Petrochemicals. He pointed out how many leather footwea produced in the country 35 cro inadequate for the population o and how much P.V.C. is likely to the gap or how many plastic ba required for preparing saplings f plantation in the country.

The first three speakers spo Marathi.

Shri C.R. Malaviya, Works Ma of D.M.C.C. Ltd., spoke on Indu hazards in Hindi. He offered th dents to come and visit D.M.C.C He explained how the accidents and to think about the reasons so prevent the recurrence of such inci

Shri S.P. Bhadang, Secretar Marathi Vigyan Parishad, Amba proposed a vote of thanks.

GUJARAT PETROCHEM MA STAGE AN EXIT

In a state known for the succe corporations set up by the Governm one Gujarat Corporation may be ma an exception by making an inglo exit from the scene, unsung and unv

The Gujarat State Petrochem Corporation Limited, set up in 1978 which was to be a harbinger of second petrochemicals revolution i state may now be wound up for of projects. If wound up it will be first corporation to fall by the way Never in history of the state has corporation has failed to take-off i past and had to be wound up.

The board of the corporation rece debated its future, it is learnt, and c with few alternatives. The main con sion of the board is that the corpora can exist as a going concern onl could initiate and implement s downstream projects in the propo Gandhar petrochemical complex, wi the Indian Petrochemical Corporatio putting up a naptha cracker plant natural gas as the feedstock.

Plastics are vital

No official explanation has been given for the sharp rise in import duties on polymers. The intention cannot be to protect domestic producers, who are already making handsome profits. One disturbing possibility is that the new Government wants to lower the priority given so far to plastics. It may be premature to reach such a conclusion, but some noises emerging from Yojana Bhavan suggest that this may indeed represent official thinking. Petrochemical complexes are highly capital-intensive and thought to be inappropriate in a strategy aimed at maximising employment. And since foreign exchange is scarce, we cannot rely on increasing imports of polymers either. So it is just possible that the new Government will be happy with a situation where the demand for plastics is curbed, in part by high prices.

We hope this will not happen. Far from being unsuitable for a strategy that emphasises rural development and employment, plastics are vital and should be seen as such. A petrochemical complex does not provide many jobs. But downstream processors are mainly in the small-scale sector and generate a huge number of jobs. Rural consumers want cheap plastic goods like PVC footwear, buckets, ropes and other household goods. Farmers need plastic pipes as well as drip-irrigation systems and plastic sheeting for mulching and for constructing greenhouses. Conserving water is of the highest importance in agriculture today, and plastics hold the key to such conservation. Drip irrigation slashes the water requirements of a variety of crops. Sheet mulching prevents evaporation, and has become the standard technology for vegetables and other produce in most countries. Plastic greenhouses are essential for the temperature control required for high-quality flowers and vegetables for export, and they also increase agricultural productivity in colder [illegible]. Plastic crates have the potential to replace wooden crates almost entirely, thus saving enormous areas of forests from denudation. This is not the only environmentally excellent feature they have. Mulching improves soil quality and cuts erosion. Drip irrigation conserves fertilisers and hence the deleterious run-off of nitrates.

If plastic prices are raised by duties, they will no longer substitute wood and metals to the extent they have the world over. Such substitution is highly desirable. Plastics are less capital-intensive and energy-intensive than metals, apart from being much cheaper. To the extent they substitute wood they conserve our forests. Raising plastic prices will tend to increase the use of metals and wood. Metals are imported at the margin, and it makes more sense to import polymers than metals.

Finally, petrochemical crackers will convert high gas fractions (ethane, propane, butane) that we produce into valuable raw materials. If this is not done, these higher gas fractions will simply be burned as fuel in boilers and power plants, and that represents a terrible waste of scarce resources which can substitute imports. No doubt crackers are capital-intensive but they are not a waste of resource since they utilise gas fractions which would otherwise be burned. Thus they conserve both resources and foreign exchange. This means there is a strong case for reducing the duty on polymers and encouraging their use. The Government, regrettably, seems to be moving in the opposite direction.

-- Financial Express

SEMINAR FOCUS ON US TECH TRANSFER

Indian exporters would have to upgrade their technology in high tech areas to make a dent in the US market. This was the view expressed by the speakers at a one-day seminar on "Doing business with the US" jointly organised by Indian Bank, the US Department of Commerce Commercial Service (FCS), Mad the Indo-American Chamber o merce, in Bangalore recently.

The main purpose of the sem to encourage technological trans exports from the US to India.

The Indian Bank Executive D Mr. B.B. Shetty, in his keynote a urged the Indian entrepreneurs t use of various facilities offered b to stay in the race for a place high-growth economies of Asia

He said besides encouraging of US technology into India, FCS in an indirect way in exports to by assisting Indian entreprene establish 100 per cent export-o units with American technology

He also suggested a few are computer software, medical elect process instrument (both electric pneumatic) and telecommunic where 100 per cent export-oriente can be set up to achieve qual superiority over other Asian natio Singapore, Hong Kong, South and Japan.

Mr. Shetty was of the view Indian exporters can make a rea in the American market only th import of their hi-tech and pr items for re-export under buy arrangement.

Otherwise Indian exports to t would continue to be garments, s sea-food, tea, coffee, etc.

Mr. Shetty said Indian com have signed the maximum num collaborations over the past four with the US.

In 1988 alone there had been as as 171 collaborations concluded the US of which 71 involved fin participation.

Mitsui to have stake in NAPCO

Iitsui of Japan is likely to partici- in the equity of National Aroma- and Petrochemicals Corporation (NAPCO) a Rs. 1,200 crore pro- to manufacture aromatics and PTA noted by Madras Refineries Ltd. Southern Petrochemical Industries poration Ltd.

Mitsui's participation is a bait to the on Government to okay the project he Japanese company is quite likely neet the foreign exchange require- nts of the project. Mitsui is one of three licensors of PTA technology, other two being AMCO of the US ICI of the UK.

A parallel can be drawn with Shell ich has agreed to raise its equity and ntribute Rs. 400 crores in foreign change towards the expansion of tional Organic Chemical Industries l. (NOCIL).

Mitsui's move should speed up the arances and comes at a time when panese companies have been reluctant participate in hi-tech projects. As per new Government policy, foreign change for mega petrochemical pro- cts will have to be raised by the pro- oters on their own.

The company sources confirmed the ssibility of equity participation by itsui though no decision has been ken yet.

The project cost has escalated from e original estimate of Rs. 800 crores Rs. 1200 crores plus. The Govern- ent is reportedly studying the revised ost estimates, and a decision is xpected soon. The promoters are con- dent of raising the finance, once all learances are received.

The NAPCO project has progressed rther than JK Petrochemicals Ltd. romoted by the Singhanias, who are et to tie up with any of the three licen- ors of technology.

The NAPCO project is to come up at Manali, adjacent to MRL refinery. The intermediates produced by the company from naphtha to be supplied by MRL are benzene, xylene and purified terephthalic acid (PTA), used in synthetic textiles, pharmaceuticals, paints, pigments, pesticides, dyestuffs, polyester films, synthetic detergents and rubber chemicals.

Tamil Nadu Petroproducts Ltd. (TPL) promoted by SPIC and the Tamil Nadu Industrial Development Corporation (TIDCO) has incorporated the process of UOP which has enhanced the quality of linear alkyl benzene (LAB), the detergent raw material.

Despite a disadvantage in the cost of N-paraffin, the feedstock, the company has enjoyed a reputation for superior quality ever since it began production.

The company is now reviewing the product-profile of Spic Fine Chemicals, which is to produce phosphate-free detergents for the first time in the country in collaboration with Henkel, the West German chemical giant.

The company proposes to produce a range of products using Henkel know-how in addition to fabric detergents as proposed earlier. Henkel will have equity participation in the new venture.

SPIC also proposes to set up a unit to manufacture Penicillin-G at Cuddalore, Tamil Nadu, with a capacity of 1000 mmu. Revised cost estimates of the project, originally estimated to cost Rs. 45 crores, are being submitted to financial institutions shortly.

SPIC has tied up with a Portugese company for Pen-G technology, as wellknown firms with Pen-G technology have refused to part with their knowhow.

Manali Petrochem to enter capital market

Manali Petrochemicals is entering the capital market with a public issue of 160 lakh equity shares of Rs. 10 each at par on January 22. The issue has been made to part-finance its Rs. 101.70 crore hi-tech project for the manufacture of propylene oxide/propylene glycol (PO/PG) and polyols which are 100 per cent import substitute products.

The company has been promoted by Southern Petrochemical Industries Corporation Ltd. (SPIC). The cost of the project is being met by an equity capital of Rs. 32.40 crores, rupee term loan of Rs. 58.71 crores, and foreign currency loan of Rs. 2.29 crores from financial institutions and an unsecured loan of Rs. 8.30 crores from the promoters.

Announcing the public issue in Bombay recently, its Managing Director, Mr. G. Raghavendran, said that located at Manali near Madras, the company's most modern plant would have an annual capacity to produce 12,000 tpa of propylene oxide for captive consumption for the manufacture of 6,250 tpa of propylene glycol and 6,000 tpa of polyols per annum. The plant is scheduled to be commissioned by April, 1990. The project enjoys an unique advantage of obtaining its basic raw materials -- propylene and chlorine from MRL and SPIC (heavy chemical division) respectively.

Propylene glycol would be used in a wide range of industries such as pharmaceuticals, food flavour, syrup, cigarettes and polyols in furniture, footwear, refrigeration, industrial insulation, automotive parts, etc. The country's entire requirements are currently being met by imports. With the availability from the indigenous source the demand for these products is likely to increase rapidly.

Being a 100 per cent import substitute product and with steady growth in demands it would not pose any marketing problem. The project hopes to break even at 42 per cent capacity utilisation. According to the projections, the company is likely to achieve a turnover of Rs. 60 crores during the first year, Rs. 70 crores in the second year and Rs. 80 crores in third year and hopes to earn a gross profit of Rs. 20 crores, Rs. 23 crores and Rs. 26 crores respectively. The company is likely to break-even in the first year and expects to earn a net profit of Rs. 3 crores in the second year and Rs. 6 crores in the third year of operations, he added.

DUTY ON TEXTILE HAND-PROCESSING UNITS HURTS MANY

A large number of textile hand processing units have been hit hard b imposition of excise duty, rend thousands working in these small- units out of job.

"More than 60 per cent of the textile hand processing units in country have become sick as a resu excise notification No. 111/87 exe ting only a limited production duty," according to Mr. Deshbar Kagzi, President of Maharashtra Textile Hand Processors' Associa

In a representation to the Pr Minister, Mr. V. P. Singh, he expressed the hope that the new G ernment would encourage rural-ba labour intensive small-scale hand cessing units by exempting the en production from excise duty as was case earlier.

At present these units are restric to process only 14,000 sq. metres cloth in the case of bleaching a dyeing and to 21,000 sq. metres in case of screen printing of cloth agai their installed capacity of 30,000 met per day, thus leaving huge capacity utilised.

Further, the value of the cloth p cessed by these units is very low a sold directly to the consumer at a ve low price mainly catering to ru demand, he has argued.

News in Brief

-GERMAN FOCUS ON RONMENT

West German economic minis- accorded high priority to the pro- of the environment, to the extent 06.3 million Deutsche marks out total of 806 million marks have towards Indo-German projects d to environment. This was dis- by Mr. Hans-Peter Repnik, State tary in the Federal Ministry of omic Co-operation.

eaking at the Indo-German nber of Commerce in Bombay tly, Mr. Repnik said the German ament's inquiry commission on ecting the earth's atmosphere' lighted the need to protect the d's tropical rain forests and this was ially relevant to India which had large areas of forest land.

said environment protection ld play a larger role in future -German trade and that Germany's get for 1990, envisaged 3.9 per cent ease in aid for developing countries. for India and the third world would suffer because of the Federal ublic's new aid commitments to the ging democracies in Eastern Europe, dded.

Mr. Repnik said there was a firm political will to provide development co-operation to India this year in the same magnitude as that given by Germany in 1989, roughly about 800 million marks.

Mr. Repnik heads an economic delegation that will hold talks with the Indian Government for exploring new areas of co-operation.

CALL TO MEET DEMAND FOR COMPUTER CHIPS

Prof. C.N.R. Rao, Director of the Indian Institute of Science (IISc), recently called for the establishment of more foundries to meet the large demand for computer chips within the country and abroad.

Inaugurating the two-day third international workshop on Very Large Scale Integration (VLSI) design in Bangalore, he said the country required at least two such foundries immediately. The industry in this area should strive to develop the competence to become export-oriented.

He said a country like India had very few options and had to decide its priorities judiciously to build up a strong technology base.

The Bharat Electronics Chairman and Managing Director, Captain S. Prabhala, in his address, said the country should not wait for the setting up of the infrastructural facilities but should go ahead and develop the various tools and capabilities needed for VLSI design and testing.

FACILITIES FOR HANDLING BASIC PETROCHEM MATERIALS

The facilities for handling basic materials like naphtha for the proposed Haldia petrochemical complex are being set up alongwith the second oil jetty which is being constructed at the Haldia dock complex of the Calcutta Port Trust, according to CPT sources.

The sources said that there is a proposal to draw a pipeline from the second oil jetty and carry the naphtha in a cradle like structure.

They said that the naphtha would have to be carried over a distance of around six kilometres between the Haldia dock complex and the Haldia petrochemical's proposed location. CPT sources said that the Rs. 35-crore second oil jetty was being constructed by Korean contractors.

CLE proposes Rs. 400 crore modernisation fund

The Council for Leather Exports (CLE) has submitted to the Centre a proposal for the creation of a Rs. 400 crore fund for modernisation of the leather industry in the Eighth Plan.

The council has also approached the Reserve Bank for forming a task force to look into the question of easing the lending norms for the industry.

The proposal for the modernisation fund is presently under the scutiny of the Ministries of Commerce and Industry and the Planning Commission. Details of the scheme will be worked out once the proposal is accepted in principle.

The fund, conceived on the lines of the one existing for the engineering industry, is sought to be financed by Plan allocations. In this context, it may be noted that the industry, at a discussion on the subject in Madras recently, had set its face firmly against the imposition of any cess on it for purpose of floating the fund.

The figure of Rs. 400 crores is based on the rough estimates made by the council on the modernisation requirements of the industry in the Eighth Plan to help it achieve the production and export targets. The council has also suggested that the scheme could be put on stream in the form of a revolving fund of, say, Rs. 20 crores.

The case for the speedy modernisation of the industry is supported by a host of reasons, the limited domestic raw material availability being an important one. As the production of hides and skins does not pick up in tune with the increase in demand, the prices, for one, have been going up at an alarming rate. Efficient and cost-effective use of the available resources is the only way to measure up to the situation, it is felt. Also the growing competition in the international market with the entry of new exporting countries on the scene calls for stringent quality standards to be maintained by Indian products in order to get a toehold in the market. Competitive pricing is another major factor. The answer to all these pressing questions lies in quick modernisation of the industry, it is argued.

Regarding lending norms, the council feels that the present norms have become outdated in the wake of the sweeping changes the industry has undergone in recent years. Besides, to achieve the ambitious plans set for the years ahead, the industry would need substantial financial backing, which will be hard to come by under the present lending norms.

The task force, proposed to be constituted of representatives of the industry and the financial institutions, will go into the lending structure for the industry and make suitable recommendations to the Reserve Bank for necessary changes and relaxations.

LEATHER GOODS EXPORTS MAY CROSS Rs. 2200 CRORE

The upswing in the export of leather and leather products recorded in recent years continues to retain the tempo with another target-shattering performance on the cards this year.

Indications are that exports will top Rs. 2200 crores against the target of Rs. 1800 crores set for the year. More importantly, this will render meaningless the Rs. 2000 crore target envisaged for the ensuing year (1990-91). According to Mr. M.Y. Hashim, Chairman, Council for Leather Exports (CLE), the projected export turnover will be nearly 35 per cent more than the Rs. 1600 crore achieved in the previous year. Till October end, exports have touched Rs. 1000 crores.

Addressing a function to m inauguration of the Centre for T and Product Development in recently, he said another signific ture of the export performance current year is that all the items leather products sector have reg increased returns, bringing do share of finished and semi-fi leather to around 40 per cent from 50 per cent last year. In garments ticular, the increase is expected nearly 100 per cent -- from R crores to over Rs. 300 crores. Th also be much higher than the tar Rs. 250 crores.

Mr. Hashim noted that the one handicap of the industry vis-a-vis target is the shortage of trained power. By 1994-95, the requirem this regard is anticipated to be 22 It is in this context that the counc taken the initiative to start the tra centre. He pointed out that this is a beginning and the council had d up plans to start an exclusive tra institute to be managed entirely b industry and financed by it and mercial banks. The outlay has estimated to be Rs. 50 lakhs and Indian Bank has come forward to up 50 per cent of the cost.

He also disclosed that the State ernment has been approached to cate suitable land for the purpose expressed the hope that this will c through shortly. Mr. A. Sahasranam Executive Director, CLE, explained background to the opening of the ce To cope with the quantum jump in activities of the industry, it is imp tive that enough trained manpow available to it at any time. Apart f starting new training institutes, council has also taken up with the G ernment the need for revamping improving the efficiency of the exis ones. Mr. M. Gopalakrishnan, Ch man and Managing Director, In Bank, inaugurated the centre, Mr. G Duraivelan, Regional Chairman, C proposed vote of thanks.

. 1,200 crore expansion plan by GSFC

ujarat State Fertilisers Company FC) has taken up an ambitious 1,200 crore expansion programme. fing newsmen about the expansion ramme, the company Managing ctor, Mr. P.V. Swaminathan, said ntly at Bangalore that the basic ineering work of the caprolactam ansion project worth Rs. 400 crores over and that civil work was under gress. This plant was likely to be mmissioned in December 1991, with roduction capacity of 50,000 tonnes annum.

GSFC has already commissioned the st phase of its plant for cogeneration steam and power. The total cost of s plant, having a capacity of 15 MW Rs. 33 crores. Work on the second ase of the 25 MW capacity plant, sting Rs. 38 crores was under pro- ess and would be commissioned by e end of March 1990, he said. The mpany was also in the process of stalling a new melamine plant with a pacity of 10,000 MT/annum at a cost Rs. 73 crores. It has already received letter of intent for this project. GSFC ready has a melamine plant with a apacity of 5,000 MT/annum. Mr. waminathan said that the company xpected 20 per cent growth rate in me- mine in the coming years.

According to him, GSFC also has lans to set up a Rs. 300 crore phos- horic acid plant, having a production apacity of 2.50 lakh tonnes of P_2O_5 er annum at Sika, Jamnagar. A new ulphuric acid plant with a capacity of 001 tonnes per day at a cost of Rs. 28 rores was also being set up. GSFC has aken the i itiative in promoting the Gujarat Industries Power Company (GIPCO). The other participants in the project were Gujarat Alkaline Chemi- cals Ltd. (GACL), Petrofils, IPCL and Gujarat Electricity Board (GEB). The total cost of this plant is Rs. 200 crores. It will generate 135 MW of power, when completed. Of this, GSFC will get about 40 MW of power. Mr. Swami- nathan said that the plant will have three gas turbines and a steam turbine with production capacities of 30 MW and 45 MW respectively. The debt equity ratio for the project will be 1:4 with the equity amounting to Rs. 40 crores. GACL was likely to get about 25 MW of power, while power supply to the rest will be in proportion to their requirement. With the full commissioning of this plant, GSFC will be practically independent of the State Electricity Board for its power requirement. Gujarat Nylons Ltd., a company promoted by GSFC, with a production capacity of 6,000 tonnes of nylon filament yarn has commenced partial production. The unit which presently manufactures nylon chips, will also manufacture yarn. The total cost of the plant is Rs. 120 crores.

Mr. Swaminathan said that GSFC has also decided to establish a desalination plant at Sika at a cost of Rs. 2 crores. About 80,000 litres per day of sewage water would be treated at this plant for recycling. On the fertiliser front, GSFC which is a pioneer in the field of bio-fertilisers, has already started commercial production of bio-fertilisers and the sales are expected to be around Rs. 40 to Rs. 50 lakhs in the current year.

CATHODIC PROTECTION

Metal and Pipeline Endurance Limited of England, better known as MAPEL, offers a comprehensive range of services and products for design, supply and installation of Cathodic protection Systems. MAPEL cathodic protection products include all types of anodes, backfill, cabling, junction boxes and fittings, thermit welding equipments, pin brazing equipments, handy-caps test stations, reference electrodes, transformers and transformer rectifiers. On the inspection side, holiday detectors, test meters, Pearson survey equipment, radiation warning lamps and pipe flange testers are known products from MAPEL range. For details contact: Sudit Polymers Private Limited, 91, Sunshine, Dr. Rajabali Patel Road, Opp. Breach Candy Hospital, Bombay-26.

IDPL

invites

Sealed tenders from prospective buyers for the sale of following items as per the details given below on Running Contract Basis for one year item No. 1 to 3.

Sl. No.	Tender No.	Brief description of disposables for customers appraisal	Accumulated Quantity Approx.	Earnest Money Rs.
1.	PT-10/89	Scrap glass vials 7.5 CC including stray 10, 15, 20, 25 & 30 ml. etc. (Mixed with few rubber stoppers & aluminium caps.) (4 MT per month approx.)	400 MT	20,000/-
2.	PT-11/89	Used Polythene (High low density) Bags of various shapes and sizes having cuts/damaged/including all waste polythene of different colours, shapes, sizes and combinations. (2 MT per month approx.)	20 MT	10,000/-
3.	PT-12/89	Used Jute bags unspoiled/spoiled and having cuts of various sizes and shapes including unspoiled/spoiled jute length of various shapes and sizes. (4 MT per month approx.)	--	10,000/-
4.	PT-13/89	a) Propylene Glycol (Imp.) (Lot basis) b) Pot. Ferrocyanide (Imp.) (Lot basis)	4.730 MT 0.065 MT	2% of the quoted value

NOTE:

1. Sale will be 'AS IS WHERE IS' basis as per details in Tender.
2. Tender documents can be obtained from the Sr. Acctts. Ex. (Cash) by sending Crossed Indian Postal Order of Rs. 50/- (Rupees fifty only) for one tender set in favour of M/s. Indian Drugs & Pharmaceuticals Ltd., Virbhadra 249 202 till one day before opening of the tenders.
3. Material can be inspected on any working day between 10.00 hrs. and 15.00 hrs. The offer shall be valid for 90 days from the date of opening of tender.
4. Tender will be received upto 2.30 P.M. and opened at 3.00 P.M. on 29-01-1990.

SR. MATERIALS MANAGER

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Fertiliser output dips

The performance of the fertiliser industry during April-October, 1989 has been far from satisfactory. According to official data, there has been a drastic decline of 38.3 per cent in the production of phosphatic fertilisers during the period.

Though the rains were bountiful, after a drought of three years, fertiliser production was affected by various constraints such as power shortage, short supply of natural gas, shortage of imported phosphoric acid and obsolete equipment.

A good monsoon implied a greater demand for fertilisers. The Ministerial pronouncements convinced that targets set for the year would be met and only a small quantity would have to be imported to bridge the demand-supply gap. With the commissioning of the fertiliser units along the Hazira-Bijaipur-Jagdishpur pipeline, a comfortable state of affairs was expected.

However, the official data shows little cause for cheer. There has been a decline in the production of nitrogenous fertilisers since August 1989. Production in August fell from 5.67 lakh tonnes in 1988 to 5.65 lakh tonnes in 1989, a decrease of 0.3 per cent, in September from 5.21 lakh tonnes in 1988 to 5.07 lakh tonnes in 1989 and in October from 5.97 lakh tonnes in 1988 to 6.61 lakh tonnes in 1989, a decrease of 6.1 per cent.

However, the fall in production of phosphoric fertilisers has been more pronounced. In April-October, 1989 the production was at 8.57 lakh tonnes against 13.80 lakh tonnes in the corresponding period of 1988 showing an overall decline of 38.3 per cent.

Prodcution in April 1989 of phosphatic fertilisers fell considerably, from 1.73 lakh tonnes in 1988 to 0.8 tonnes in April 1989. This sho decline of 53.1 per cent. Simila production fell in the successive as against the same periods in t vious year. In May production d by 49.2 per cent over the previou in June by 46.5 per cent, in July b per cent, in August by 33.5 per ce in September by 32.9 per cent.

It is interesting to note that ph tic fertiliser production fell short target of 2.10 million tonnes by as as 20.7 per cent during 1988-89. had been mainly because of the age of imported phosphoric acid

The fertiliser industry has been f various Government created prob The previous government had cha the retention pricing scheme, link depreciation and capacity utilisa The result was that old units coul achieve capacity utilisation norm for the industry due to obsolete mac ery and also could not force a ris production as that would only add t prevailing glut caused by the drought.

The industry has not yet recov from the impact of the drought.

NFL VIJAIPUR PLANT POSTS RECORD OUTPUT

The Vijaipur plant of the pu sector National Fertilisers Ltd. (NF near Guna, (M.P.), created a new p duction record of 5.96 lakh tonnes urea utilising 106.6 per cent of its est lished capacity in the first nine mon of 1989-90.

An official release in Guna, said plant helped increase the countr foodgrain production by six mill tonnes by producing more than 13 la tonnes of urea during the last two ye of its going critical. It also produc more than 3.47 lakh tonnes of ammo utilising 103.9% of its established ca city between April and December 19

TO BREAK FERTILISER MNC's MONOPOLY

Key role for PDIL, FEDO

e Union Government has initiated ve to break the long monopoly of national giants like Snam Progetti ly and its Danish associate, Haldor oe, in execution of fertiliser pro- in the country.

begin with, the government has a policy decision to promote and gthen the indigenous fertiliser con- ncy units in a big way. The objec- is to allow these units to grow and ire a sufficiently strong financial to take on the foreign giants while peting with them for bagging fer- r projects.

consensus has also emerged within government to give adequate sup- to the indigenous fertiliser consul- y units and ensure that they are not riminated against in awarding con- s.

high-level meting, held in New i recently, discussed this issue adbare. The meeting was attended enior officials of the Department of ilisers, Finance Ministry and the ning Commission.

Although the main issue on the nda was to discuss the annual plan the fertiliser department, the discus- veered round to the scope of ope- ons of domestic fertiliser sultancy units like the Projects and velopment India Limited (PDIL) and tilisers and Engineering Design ganisation (FEDO), a divisio: of the chin-based Fertilisers and Chemicals vancore Limited (FACT).

Snam Progetti and Haldor Topsoe are olved in implementation of almost all fertiliser projects set up in the coun- in the last decade. They have bagged st of the ammonia-urea projects that ve come up in the last nine years. en where the domestic consultancy its have won the contract, the Italian giant has placed a more dominant role in the execution of the project.

With a view to breaking this stranglehold, the government has decided that in the annual plan for the next year, special financial allocations would be made for PDIL and FEDO.

Special financial support for the two organisations in the next year's plan will only be the first step in ensuring that they strengthen their infrastructure and expertise in this area.

Other steps in this directioin will include encouragement to the two units to expand their operations and accord some weightage in their favour while selecting prime contractors for fertiliser projects.

Even where PDIL and FEDO are collaborating with Snam Progetti or Haldor Topsoe, the government effort would now be to ensure that the Indian firms get a larger share of the business generated from the projects under implementation. At present, the foreign giants corner a major chunk of the business mainly through import of capital equipment and components.

It was pointed out that PDIL and FEDO have done well in terms of timely execution of the few fertiliser projects they undertook in the past. Even the functioning of the plants set up by them (for instance the Hazira plant of IFFCO by FEDO) is satisfactory going by the high capacity utilisation achieved by them.

The fertiliser department is understood have also claimed that PDIL and FEDO have acquired the expertise in all unpatented process know-how available for setting up fertiliser projects. Hence, they should be allowed to play a larger role in execution of fertiliser projects in preference to the foreign giants. The government move to break the monopoly of Snam Progetti and Haldor Topsoe is also in response to a plea from the domestic fertiliser industry that they be freed from the stranglehold of these foreign giants. Fertiliser industry leaders are reported to have approached the Government in this connection, soon after it took over in December 1989.

The industry also wanted the new government to withdraw the Congress-I regime's restrictions imposed on it to import fertiliser equipment and technology only from Snam Progetti. It pleaded that there should be freedom for buying the best equipment and technology from anywhere in the world.

As a result of these restrictions, the foreign giants had monopolised the Indian fertiliser industry and the main casualty were PDIL and FEDO, which had the necessary expertise in this field, but were denied any opportunity to prove their mettle. The Government appears to have resolved to remedy this situation.

5-22 PER CENT CCS FOR 25 ITEMS

The Union Government announced recently the cash compensatory support scheme (CCS), ranging from five to 22 per cent, for 25 exportable items. The CCS effective from January 5 will be applicable till March 31, 1992.

CCS is given to selected export items to compensate for certain disadvantages like unrefunded indirect taxes, freight disadvantages and product/market development cost.

The items covered under CCS include sodium sulphate, methyl acrylate and plastic electrical accessories.

CCS would be effected in pursuance of offers/contracts received and finalised on or after January 5 and would be in force for little over two years till March 31, 1992.

Science research must help develop rural aras

Priorities in science research should go to sectors that will help generate income and employment in rural areas. Land and water-based occupations will have to be the mainstay of the right to work principle but they are crying for added attention. This was stated by Dr. M.S. Swaminathan, while addressing the 59th Annual Session of the National Academy of Sciences in Hyderabad on January 6, 1990.

Even where there is scientific know-how, its conversion into economically viable and ecologically sustainable technology has often been neglected and unless these problems are attended to, the country will continue to stagnate in a situation where the human resource is under-valued and physical assets are over-valued.

Dr. Swaminathan said the task of making the right to work a meaningful and not a cosmetic one is extremely difficult considering the demographic profile of our population. There is also a mismatch between the systems approach needed to achieve results and the uni-dimensional administrative structures operating in the field.

For example, in the farm sector, success in generating skilled employment will depend upon success in linking the primary, secondary and tertiary sectors of economic activity in a mutually reinforcing manner. A dynamic and socially relevant services sector needs to be developed but this will call for a new deal for the self-employed. At present, all the deals are only for those having employment in the organised sector, Dr. Swaminathan observed. If the goal of work for all is to be achieved, the path of Gram Swaraj outlined by Gandhiji should be followed. Unfortun bureaucratic attitude promotec ing that the Government w everything and people coul passive spectators, Dr. Swa said.

In order to help discussion of national importance, and c with consensus view-point of s and technologists, he suggest nising a forum on "Science, Soc Public Policy" jointly by the National Science Academy, th Academy of Sciences, the Science Congress Association National Academy of Sciences. tributing to and for deriving from the onward march of scie technology, Dr. Swaminathan su the following as important s better integration of governme nomic environmental and techn policies; partnership between i -- both small and large, private and co-operative -- and universi research institutions in developm dissemination of "green techno enlarged support from basis research and education etc.

SETTING UP OF BIO PLANTS MAY CROSS TAR

The target of setting up of ov a million bio-gas plants during t enth Plan will be exceeded. By of March 1989, over seven lakh plants were constructed and the of setting up of another 1,60,000 in 1989-90 is likely to be achie the first four years of the curren the annual targets were contin being surpassed. The actual ac ments were 1,90,222 plants (as a the target of 1,50,000 plan 1985-86, 2,00,833 (1,50,00 1986-87, 1,73,659 plants (1,20,0 1987-88 and 1,67,124 (1,50,0 1988-89. The rapid progress in t few years in this direction has be to the package of measures taken Department of Non-Conven Energy Sources (DNES).

DGTD setting up knowhow information centre

he office of the Director General of hnical Development (DGTD) is in process of setting up a technology rmation centre attached to it.

Announcing this in Bangalore ently, the DGTD, Mr. H.C. Gandhi, that the main objectives of the tre would be to collect, analyse, and seminate information on industrial nologies. The centre would also pro- e information on the sources of avai- ility of commercial proven nologies and the future development nds.

Mr. Gandhi, who was inaugurating a -day seminar on "Emerging technol- es -- challenges and opportunities" ganised by the Confederation of gineering Industry (CEI), stressed the ed to put in substantial efforts towards dustry-related research and develop- ment.

The country's current expenditure in R and D, according to him, is a mere one per cent of the GNP as against 2.5 per cent to four per cent elsewhere in the world. "This is an unsatisfactory situation," Mr. Gandhi commented. Besides, while a substantial portion of the R and D expenditure in the industrialised countries came from the industry itself, in India, the Government played a major role, "Industry must, therefore, lay greater stress in this direction," Mr. Gandhi said.

The technology advisory groups, set up by his office to undertake studies on the perspective technology scenario in respect of a few important industries, had assessed the existing technology in the country in terms of quality, design with manufacturing techniques, and the status of contemporary international technology.

This had helped identify technology as are relevant to the country. A few more areas had been added recently for similar studies. Speaking on the occasion, the CEI Chairman (Southern Region), Mr. V. Ramakrishnan, stressed the need to foster an indigenous base for technological development.

Pointing out that the use of modern cybernitics and informatics technologies are opening up new patterns of industrialisation, Mr. Ramakrishnan said that this has given an opportunity for the country to bring out cost-effective decentralised modes of production.

Others who spoke were the past chairman of CEI (Southern Region) Mr. Kumar Mahadevan and the convenor of the Engineering Services Panel of CEI (Southern Region), Karnataka, Mr. C.P. Rangachar.

Industrial policy to be recast

The industrial policy will be changed "radically, drastically and substantially" with special emphasis on employment generation, poverty alleviation and thrust to rural development, the Planning Commission Deputy Chairman, Mr. Ramakrishna Hegde, announced recently.

While there is no going back on mixed economy, investments in the public sector would be reviewed to ensure the accountability of the units in the sector, particularly in terms of discharge of social obligations, Mr. Hegde said.

"Our belief is socialism must serve some social purpose. This does not necessarily mean privatisation", adding "unfortunately now in the name of public sector, everything goes including five-star hotels."

Briefing newsmen on the three day deliberations of the wholetime members of the reconstituted Planning Commission, Mr. Hegde said a draft Approach Paper to the Eighth Plan (1990-95) will be ready by the end of January 1990.

The Approach Paper will be considered by the National Development Council (NDC), Mr. Hegde said.

Apart from NDC, the Approach Paper would be taken up at regional meetings of Chief Ministers. The first regional meeting would be held in February with Chief Ministers of the Southern States.

Asked about the 1990-91 Annual Plan, Mr. Hegde said this was being prepared on the basis of available data regarding resources. This would be done before the Approach Paper was finalised.

The changes in the industrial Policy Resolution of 1956 and subsequent Government statements in this regard would be finalised soon after wide-ranging discussions with captains of industry.

Mr. Hegde said the Approach Paper would be drawn up in accordance with the policies, programmes and priorities of the new Government and also the ideology of the National Front Government.

In the meanwhile, the Commission would also have the views of various representatives organisations like the Chambers of Commerce and Industry, since there "is going to be a radical change" in the industrial policy.

The consultation with the captains of industry was to ascertain whether they were prepared to invest in the priority areas set by the new Government.

Replying to a question, Mr. Hegde said the working of the public sector units, particularly in the spheres of steel, petrochemicals, fertiliser and power would be reviewed. This exercise would be designed to take "corrective action" and remove weaknesses that crept into the functioning of the sector.

Mr. Hegde said there was consensus at the meeting on the need to reduce the number of Centrally-sponsored schemes. "We would rather have more and more of panchayat, district and zilla parishad sponsored schemes than Centrally-sponsored schemes,".

How drastically these schemes should be reduced will be decided by "the end of January 1990." Jawahar Rozgar Yojana and Nehru Rozgar Yojana would be recast, and their names will be changed with "good ones."

Mr. Hegde said local institutions would have a decisive role in choosing the kind of employment to be provided to the rural unemployed. There w course, be direct funding to panc institutions but not from "Prime M ter to District Magistrate".

The State Governments "will n bypassed and we will function w the federal framework". The fund the local bodies would be throug concerned State Governments".

He would not be able to say any immediately about resources fo Eighth Plan and measures to mob them. For this purpose, he would discussions with the Finance Min

The Commission would also ha await the recommendations of the N Finance Commission which had alr submitted its report to the Presid

Asked about the growth target fo Eighth Plan, Mr. Hegde said this w be indicated in the Approach Paper. however, pointed out that whateve the growth rate, it should have releva to the welfare of the people.

No doubt the growth rate in the five years had been extremely good much more than in many other de oping countries, but what were results? Did it in any way lessen intensity of the mounting unempl ment problem?

The new Government as well as previous ones had been talking of p erty alleviation and what was the ference, Mr. Hegde was asked.

He said the only difference is that present Government has the " conv tion and will to do which the previ Government lacked."

Regarding changes in the indust policy, Mr. Hegde said agricultu based industries will get a more imp tant role under the present scheme things.

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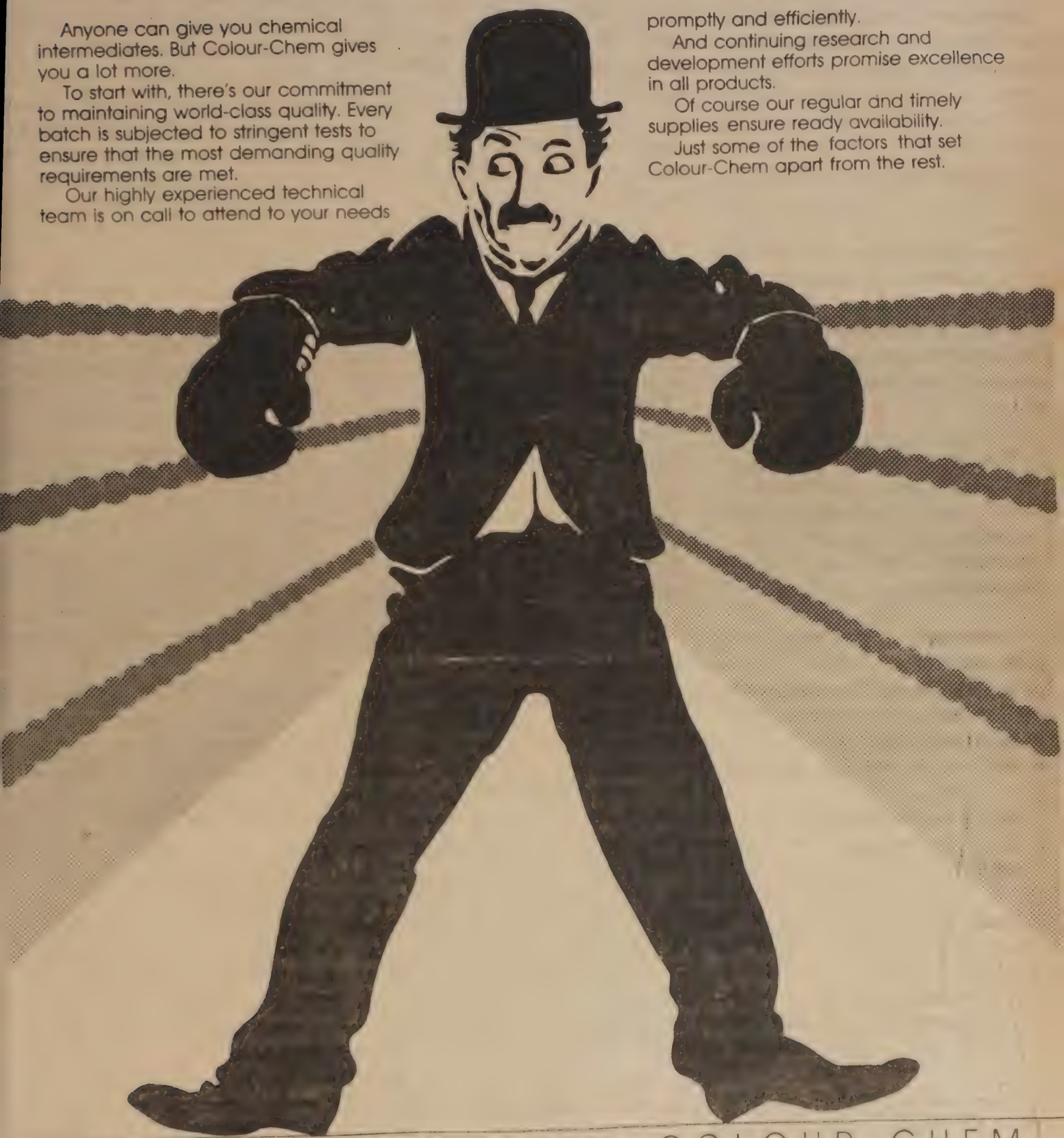

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GSFC sees scope for more plastic units

The Gujarat State Fertilisers Company (GSFC) Managing Director, Mr. P.V. Swaminathan, has urged the State entrepreneurs to set up industrial units based on the plastic raw materials of GSFC.

While delivering the keynote address at the meeting of "Plastic processors and entrepreneurs" held in Bangalore recently, he assured that the growing demand of different plastics raw materials would be met by GSFC as the company's Rs. 1200, crore expansion and diversification programme was under implementation.

He particularly referred to the great scope for development of the small scale units based on GSFC's acrylics which would in turn create job opportunities for the people of Karnataka.

Mr. Swaminathan said the consumption of GSFC's plastic in the country was 13,800 tonnes and this could go upto as high as 21,500 tonnes. Similarly, the consumption in the southern region was 1930 tonnes and in Karnataka it was 315 tonnes which could go up to 2600 tonnes and 500 tonnes respectively.

The main reason for the faster growth of various plastics in the country was the change in the lifestyle of different segments of the people and particularly the changing preferences of the middle-class for plastic house-hold materials.

The plastic industry was one of the important components of India's ongoing industrial revolution and the GSFC had played a pioneering role in the development of plastic industry in the country, he added. Mr. S.R. Mody, company's Chief Marketing Manager, in his address said that Karn accounted for around Rs. 20 c sales of the GSFC turnover. He also that in an age of consumerism v credit purchase facilities were exp ing fast and growth rates registe higher trend with rising competitio future of plastic industry was bri than ever before. Mr. V.S. Mu Chief Marketing Manager in char applications development explaine latest applications of nylon-6, mela and acrylics innovated by G through its application develop centre. He emphasised the rol nylon-6 in energy saving and op tional efficiency in various indust Speaking on the occasion, the C man of the CEI (Southern Region) R. Ramakrishnan, stressed the nee foster an indigenous base for techno ical developlment, which is contem ary in all aspects, while at the same t using technology developed elsewh as "a perennial source of pedagogy, i tation and improvement".

Big rise in ONGC output

Production of oil and gas by ONGC creased substantially in 1989 com-ared to the previous year due to var-us projects undertaken by it. The roduction of oil in 1989 was 31.07 mil-on tonnes as against 29.2 million onnes in the preceding year, supplies f gas also "showed an impressive ncrease" in 1989, an official release aid in New Delhi recently.

Gas supplies were extended in 1989 o 13 new consumers engaged in diverse ndustries like chemicals, textiles, power eneration, fertilisers, brick manufactur-ng, tea plantations and domestic users.

The total increase in terms of oil and il equivalent of gas was about 4.9 mil-ion tonnes in 1989 compared to the production in 1988. Oil and gas strikes were made in 11 new prospects in 1989. Prominent among these were Batun-milli, Adiyakkamangalam, Lingala (Southern Region), Khoraghat (Assam) and Kutch offshore. Three major hydro-carbon discoveries were made in the Southern Region during the period. The Southern Region is poised for more than a ten-fold increase in production in the Eighth Plan compared to the Seventh Plan. A regional grid is also being planned for optimal utilisation of the hydrocarbon areas.

A memorandum of understanding (MoU) was signed between ONGC and British Petroleum for co-operation in the exploratory work in the Himalayan foothills and Ganga valley, says an ONGC report from Guwahati. ONGC's efforts to internationalise its operations received a big thrust with the signing of agreements for exploration and consul-tancy with a large number of interna-tional companies.

During the year, ONGC had also ent-ered into a production sharing agree-ment with Agip (Italy) for exploration of an off-shore block in Sarawak, Malaysia. Meanwhile, ONGC com-pleted the seismic surveys in offshore Vietnam.

U.V. RAO JOINS RIL BOARD

Mr. U.V. Rao, Managing Director and Chief Executive Officer of Larsen & Toubro Ltd., has joined the Board of Directors of Reliance Industries Ltd. Mr. Rao has been associated with L&T since 1956. From a sales manager in 1957, he rose to the position of exec-utive director in 1973. In this capacity he held various positions including charge of L & T's associate and subsid-iary companies. Mr. Rao resigned from L & T's board in end December, 1988 and joined the United Breweries group as President of electronics and energy products.

On April 28, 1989, he was back to the L & T Board as Chief Executive Officer.

Iran suggests trans-Asia gas pipeline

An Iranian proposal for a 3,300-km trans-Asia natural gas pipeline from Bandar Abbas (in Iran) to Calcutta, costing $ 11,700 millions, symbolising an "Asian energy initiative" was among the high points of the last day's proceedings at the 12th annual conference of the International Association for Energy Economics (IAEE) recently.

The conference was formally closed with a valedictory address by the former Defence Minister, Mr. K.C. Pant. The valedictory session was also attended by Mr. Hiren Bhaya, former member of the Planning Commission.

The proposal for the pipeline was made by the Iranian Deputy Minister of Mines and Metals, Mr. Ali Shams Ardekhani. He was delivering the 'distinguished address', which started off the final day's proceedings at the conference.

Mr. Ardekani, who is a qualified energy economist -- having been among the pioneers in the field of solar energy economics, said that gas from Iran could be piped for use in India and Pakistan. He envisaged a 100 cubic metre-per-day pipeline from which Iran, Pakistan and India would draw 10, 20 and 70 cubic metres of gas daily respectively.

The Iranian Minister said the pipeline could be laid from Ahmedabad to Calcutta. The cost of gas at the Indian border would be of the order of $1.6 per million units, against the current Indian gas cost of about $3.6 per million units. More important, according to Mr. Ardekani, the pipeline would save precious hard currency now used for oil imports, both in India and Pakistan.

Mr. Ardekani noted that India imported at the rate of over 4.5 lakh barrels per day of oil, this import bill absorbing (even at low oil prices) about one-fourth of India's hard currency earnings. The situation was similar in Pakistan. In keeping with the conference theme of 'Energy, environment and development', he was "presenting a solution for the sub-continent's energy problem, which provides cheaper and cleaner energy than oil and coal, and in the process, will create jobs and technology transfer to participating countries.

In a short interview with the press Mr. Ardekani said he was a great votary for "sending our gas eastwards, instead of the long-standing trend to export it westwards." Europe has an insatiable appetite for energy", he said, adding that Iranian natural gas accounted for one-fifth of the world's reserves. Dispelling Western apprehensions about the pipeline in the light of the political and military tensions in the region, Mr. Ardekani said the pipeline "would be a good vehicle to reduce tensions."

"If Brezhnev can do it by succeeding on the Trans-Siberian pipeline project despite opposition, we can also do it.

Countries of the region will have to learn that "if you're poor and belligerent, it will cost you a lot." Specifically for India, the pipeline would be a worthwhile cost-effective investment in the long term. "It's always yours, anyway. You can also transport other things through it, when it is not occupied transporting gas. Even water, for instance. "Probably even other new energy resources, since the age of hydrocarbons is anyway getting over".

"Energy issues are different for the West and for the developing countries. They deal with rising energy consumption levels in the context of per capita incomes ranging around $15,000, whereas for us the per capital incomes is still around $4,500." The problems and priorities are thus different, although the IAEE conference provided ample meeting ground around the problems of the greenhouse effect, and global warming.

But we are all united in energy conservation efforts in the long term. " is better than clean energy to su life." The only thing the develo countries said was "we have a pro here, we will solve it ourselves. I want to help, help."

India and Iran had the basic te logical expertise to build the pip It was only the manufacturing c large number of jet-like compre that would require a sustained con effort. The pipeline would take fou years to build, and would "pay for i in just four years.

OIL DRILLING: RELIANCE INTEREST WANES

Reliance Industries Ltd. (RIL) a sister outfit, Larsen and Toubro (L T) plans to enter the oil exploratio on the back-burner.

The Ambanis are clearly loo afresh at the option as Government rently allows private parties to go i contract onshore and offshore dri Recently, Reliance Industries, Ll Steel, Essar and Aban Lloyd bid tender for four mat-type rigs. The and Natural Gas Commission (ON has allotted one rig each to Lloyds and Reliance and two to Aban L Reports are Reliance is not kee placing a rig at the disposal of O and may offer it to Lloyds Steel.

Similarly, Larsen and Toubro ar to place any bids for the recent te for six on-shore and six offshore though they may make a formal b the coming days. Reports are that is keen on getting a bulk order fo to 12 rigs to make the entire oper viable but there is no way it wi obliged as there are competing pa The grandiose plan of the Amba to get the offshore blocks for the vate sector to start exploration an ting up refineries and crackers to integrate operations. But the Cen just not keen on allowing private s parties in direct oil exploration.

Prestigious pipeline project hanging fire

The National Front Government is nderstood to be taking a fresh look at e nearly Rs. 700 crore (1331 km long) andla-Bhatinda petroleum product ipeline that has got bogged down for early a year in a controversy between e petroleum and railway ministries.

The World Bank aided project with foreign exchange component of about s. 200 crore, considered the biggest of s kind after the Rs. 1700 crore HBJ ipeline, has been pending with the Union Cabinet for approval for about a ear, oil industry sources said.

The Public Investment Board (PIB) leared the project on January 20 last ear. The six million tonne capacity ipeline, which will traverse through our states -- Gujarat, Rajasthan, Harana and Punjab -- has been strongly pposed by the railway ministry on grounds that it will take away a large chunk of its revenue by way of petrolum products freight traffic on its proposed railway line on the same route.

Faced with conflicting claims from the two ministries, the then Congress-I government apparently put the project nto cold storage for sometime, industry sources said.

The petroleum ministry has, in its ubmissions before both the Planning Commission and PIB maintained that he product pipeline, besides fulfilling a long felt need of the north-western region, would save Rs. 70 crore per year.

With the new government taking over, the petroleum ministry has once again raised the demand for expeditious proposal of the public sector Indian Oil Corporation claiming that both the railway and petroleum lines could co-exist without affecting each other's prospects, he sources said.

Industry sources said the northwestern region comprising Jammu and Kashmir, Punjab, Haryana, Himachal Pradesh and Western Uttar Pradesh. Rajasthan, Gujarat and Madhya Pradesh and Union Territory of Delhi constituted 38 per cent of the national demand for light and middle distillates namely motor spirit, kerosene and diesel.

The current deficit of petroleum products for this region is about three million tonnes. The deficit is estimated to go upto about nine million tonnes by 1992-2000 and 15 million tonnes by 2004-2005 even after considering operation of the six million tonne Karnal refinery in Haryana by 1995-96.

But the Karnal refinery itself has been inordinately delayed and the Soviet Union which is aiding the project, has asked the government to expedite it.

Oil industry sources claimed that the economic evaluation carried out by the Planning Commission's project appraisal division indicated that the economic cost of transportation by railways would be 2.5 times higher than that of the pipeline.

The sources said even without considering any investment on track and ignoring transit loss the present value of capital and operating cost of the pipeline would work out to Rs. 542 crore vis-a-vis Rs. 1365 crore of the railway option.

However, the railways have challenged the authenticity of the data during the deliberations of the PIB. The oil industry sources said cost of transportation by pipeline would work out to Rs. 188 per tonne against Rs. 265 per tonne of the railways.

The railways have estimated that about 700 km of railway track, that is fifty per cent of the total length, was required to be converted to broad guage on the Kandla-Bhatinda route at an estimated investment of about Rs. 450 crore.

But oil industry sources argue that the railways would have to invest an additional Rs. 400 crore by way of rolling stock. These sources claim that total investment of railways for movement of six million tonne products was estimated at Rs. 850 crore and corresponding investment for movement by pipeline would be about Rs. 650 crore.

The sources quoted a report of the Planning Commission steering committee on perspective planning for transport development that transportation of petroleum products by pipelines could be economical for demand levels greater than 1.25 million tonnes, and at present about 2 to 2.5 million tonnes of petroleum products are moved by railways from Kandla.

BALCO OUTPUT UP

Bharat Aluminium Ltd. (BALCO) has registered an all round increase in production during the quarter ended December 1989.

The output of 24059 tonnes of saleable metal during October-December, 1989, was higher than the previous quarter as well as the corresponding quarter of last year which stood at 23,546 tonnes and 23,867 tonnes respectively.

The production of alumina hydrate stood at 47,705 tonnes during the same period, which is also higher than the figure of 46,220 tonnes and 44,745 tonnes during the previous quarter and corresponding quarter of last year.

NEW PRESIDENT FOR IICHE

The Director (Operations) of the Indian Petrochemicals Corporation Limited (IPCL), Mr. K.N. Venkatasubramaniam has been elected President of the Indian Institute of Chemicals Engineers (IICHE) for the year 1990, an Indian Petrochemicals Corporation Limited spokesman said in Baroda.

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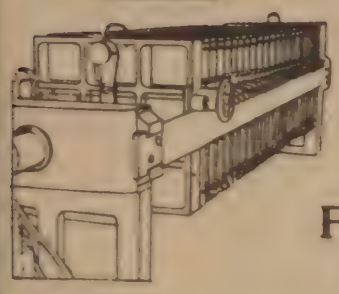

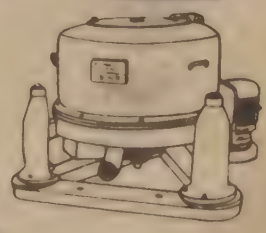

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Highlights in Chemical Technology (Part 2)

AN ULTRA-SOUND METHOD FOR DEGREASING METAL PARTS ON THE HORIZON

Most methods for removing grease from metal components employ chlorinated solvents, thus requiring expensive environmental controls. Recently, a solvent-free process was started up at a bearings plant at Goteborg, Sweden, run by SKF Svenge AB. Cleaning performances is comparable to those processes that use trichloromethylene. Capital costs are about the same as costs in Northern European countries where recovery systems for chlorinated solvent vapors are required, operating costs are 'slightly lower'.

Metal parts -- covered with grease, metal particles and small pieces of honing stones -- are cleaned in a 4-step process. They are first flushed with an aqueous solution containing 3% surfactants at 50-60°C. While immersed in the solution, the metal parts are bombarded with ultra sound waves. The parts are then conveyed to an ambient temperature cooling bath of dewatering oil (a low viscosity oil with a boiling point of 240-270°C and low vapour emissions). Finally, the components are air-dried with a blower. SKF, together with equipment maker Durr GmbH (Stuttgart, West Germany), is offering the technology for license. (*Chem Eng*, 10/1989, p. 23).

PCBs AND DIOXINS DESTROYED BY SOLAR ENERGY

In a demonstration project, researchers at Sandia National Laboratories (Albuquerque, N.M) have used sunlight to destroy salicylic acid in water. The experiments, claim the scientists, demonstrates that solar energy could be harnessed to remove organic pollutants such as PCBs or dioxins from polluted waters. The Sandia process focuses sun-light concentrated to the equivalent of 30 to 60 suns (about 500000 W covering a 10-ft² surface) onto flowing water carrying TiO_2 as a photocatalyst. In less than 15 secs, 30 ppms of salicylic acid was reduced to p.p.b levels.

Ultraviolet light initiates the process by kicking TiO_2 electrons into a conduction band creating positively charged holes. The electrons and holes react with water, dissolved O_2, and added H_2O_2 to generate hydroxyl radicals and peroxide ions. These reactive species oxidize any dissolved organics to CO_2, water and simple acids that can be neutralized.

In their demonstration project salicylic acid and catalyst mixture flow through either a long glass tube surrounded by a parabolic trough to focus the light, or over an 11-ft waterfall illuminated by up to 20, 400 ft² heliostat (sun-tracking mirrors). The researchers also report that despite the intense solar light, flow rates of 20-70 gal/min. kept temperatures below 70°C. (*Andl. Chem*, 7/15/89, p. 834 A).

N-PHENYLMALEIMIDE — A NEW SPECIALTY CHEMICAL FOR ABS PLASTICS

Aristech Chemical Corporation (USA) has developed its first specialty chemical called N-phenylmaleimide. It is a monomer based on two staple Aristech products aniline and maleic anhydride. This new specialty chemical was produced with technology by the company's research group in cooperation with its specialty chemical group. The N-phenylmaleimide is used in conjuction with plastics such as ABS to improve their heat distortion properties. It will have a big market in plastics used in auto industry. Automakers are looking more towards plastics for reducing car weights. They are concerned about sunlight exposed parts of plastics which are vulnerable to heat distortion. Aristech is betting that addition of the new chemical which combines with the resin through some copolymerization, will help overcome heat problem (*CMR*, *9/25/89*, p. 9).

CARBON DIOXIDE GENERATED FROM COAL FIRED PLANT PUT TO PRACTICAL USE

Researchers at Argonne National Laboratory (Chicago) have found that increasing the amount of carbon dioxide produced from coal-fired plants may help to eliminate its emission. Specifically they have developed a method for burning coal in a mixture of pure oxygen and recycled coal combustion gases to increase the content of carbon dioxide from 15 to 95%. The CO_2 that the process yields could be used for a number of applications such as enhanced oil recovery operations, in granaries, or in refrigeration systems.

Use of the process would react in a coal-fired plant that essentially is emission -- free, according to Argonne researchers. In enhanced oil recovering the carbon dioxide would be used to help oil flow more freely. Also when added to nitrogen, the mixture could be used instead of air in grain silos to reduce fire risk and rodent damage inside silos, or the waste gas could be used in refrigeration systems that employ carbon dioxide as the working fluid to remove heat. (*R & D*, 12/1988, p. 3).

GENERAL ELECTRIC UNVEILS NEW POLYMERIZATION TECHNOLOGY FOR ENGINERING THERMOPLASTICS

General Electric Co. (USA) has recently unveiled a new polymerization technique that may expand the market for thermoplastic resins by making them easier to process. The formulators can now work starting with resins that flow, when melted, like light machine oil. Thermoplastic composites are usually [illegible] of graphite or glass fibres

embedded in a plastic matrix. The reinforcing fibres must be infiltrated by a liquid resin, typically a thermosetting resin, that must flow readily to fill all voids and assure a solid bond once the material hardens.

Current engineering plastics are too viscose to penetrate fibre bundles easily. To solve this problem with polycarbonates the firm uses precursors having cyclic atomic structures. The rings on these precursors have the same chemical composition as the polycarbonates but only one-fiftieth their molecular weight. They flow readily when melted. A catalyst opens the rings and hooks them together in long linen chains having the polycarbonate's physical properties. The firm's proprietary research has focussed on engineering resin cyclics, particularly polycarbonates, polyetherketones. 'While this technology is still in its infancy with respect to processing and potential applications, the company believes that this breakthrough will open the way to a new era for engineering thermoplastics' reports Dr. J.W. Verbicky. In particular it holds long range possibilities for a new generation of cost-effective, light weight, thermoplastic composite materials.

This six year old technology has spawned over 50 US. patents. The firm has also developed catalyst formulations with varying trigger points that polymerize the resins in seconds or minutes. The new cyclic materials are solid at room temperature. They melt at approximately 200°C and are polymerized at 250°C to 300°C. (*CMR*, 9/25/89, p. 40).

AN ALTERNATING METHOD TO PRODUCE FORMALDEHYDE FROM BLEACHING POWDER FOR POULTRY INDUSTRY

Formaldehyde gas for fumigating poultry buildings, incubators and hatching eggs is often produced by the simple but hazardous method of mixing liquid formalin permanganate.

Now Japanese researchers from the Gifu Experimental Station have devised an alternative method, using bleaching powder, instead of potassium permanganate. Researchers have shown conclusively that the concentration of atmospheric formaldehyde made from formalin with the same weight of bleaching powder was similar to that produced using the traditional potassium permanganate method. (*Japanese Poultry Science (1989)*, 26-23-28) and (*Poultry Intl.* 9/1989 p. 24).

ARTIFICIAL INTELLIGENCE IN PROCESS CONTROL

A timely and practical publication in USA examines all aspects of artificial intelligence (AI), expert systems and knowledge-based development of process control and management. The publication contains detailed information on ways to apply AI to typical process control problems and focusses on procedures for monitoring, adjusting and optimizing continuous flow processes. It presents methodologies, techniques and solution strategies for solving real industrial problems.

With coverage of process control development in both traditional computing environments and predesigned expert system shells, the text also demonstrates methods for managing large-scale intelligent automation projects. Discussions are devoted to many important topics, including simulation, statistical process control, scheduling, operator decision support, integrated AI and distributed AI.

Also described are such subjects as domain-dependent solution shells, knowledge engineering and project organization, alarm management, cooperating expert systems and development and delivery environments. (*"Artificial Intelligence in Process Control"*. By Michael Stock, 6 by 9 inches, 210 pages. McGraw Hill Publishing Company, 11, West 19 St., New York, N.Y. 10011. Price $37.50.)

A PRECISE DEVICE MEASU METABOLIC RATE OF CEL

Scientists at Molecular Devices C Menlo Park, California, have inve an instrument called the silicon mi physiometer that detects the respo of small numbers of living cells wide varieties of physical, chemical biological stimuli by measuring metabolic rate of the cells as refle by the production of lactic acid carbon dioxide.

The device is based on the con ny's light addressable potentiome sensor (LAPS), in which an alterna photocurrent through an electro insulator -- semiconductor interfac used to measure electrochem changes in the electrolyte. In the con microphysiometer, cells are im bilized on or near the insulating la of a LAPS device. The LAPS sensi ity detects changes in the pH of the ture medium bathing the cells.

According to J. Wallace Parce, Di tor of research at Molecular Devi such changes accurately reflect chan in the catabolic rates of the cells response to numerous stimuli, includ lig and receptor interactions and cy toxic and cytopathic effects. The te nology could find numer applications for studying the effects chemicals on cells, including repla ment of the Draize test for ocular i tancy, etc. (*C & EN*, 10/16/89, p. and (*Science* **246**, 243 (1989)).

A NEW PROCESS TO MANUFA TURE TETRAHYDROFURAN FROM MALEIC ANHYDRIDE

B.P. Chemicals Inc., as a spin- from its maleic anhydride technolo has developed recently a new proc for producing tetrahydrofuran (THF) direct hydrogenation of maleic an dride at around 250°C and pressure 40 bar. The yield of THF is reported be above 95%. (*ECN*, 11/6/89, p. 2

MASTERS PROGRAMME WITH STRESS ON MANAGEMENT IN MANUFACTURING MOOTED IN USA

One problem in US manufacturing industries says Northwestern University, is that engineers and managers often have a hard time talking to one another. To help bridge the gap, NU's Kellogg School of Management and McCormick School of Engineering & Applied Science have joined forces to offer a graduate programme leading to a new degree, the Master of Management in Manufacturing. Courses will be divided into three major groups' a general management course, a required manufacturing course and electives. The programme will include laboratories where products will be redesigned and actually manufactured, with the assistance of computer technologies. Students will spend the summer between the course's two academic years in an industry internship. Prerequisite for the programme include a bachelor's degree in engineering or science and 'significant industrial experience'. First classes will start in the fall of 1990. (*C & EN*, 9/25/89, p. 32).

NOVEL PROPRIETORY CATALYSTS FROM EXXON CHEMICAL'S RESEARCH

Exxpol is the trade name of a new family of proprietary catalysts that allow olefin-based polymers to be tailored with a high degree of molecular precicion. Developed at Exxon Chemical's (Baytown, Tex) Research Centre, the single site catalysts (as opposed to Ziegler Natte Catalysts, which are multiple site) yield highly uniform polymers from ethylene and propylene.

The new catalysts will be used commercially for the first time in a 15,000 tonne-a-year unit the company is building at Baton Rouge, La, that will make novel linear ethylene-based specialty polymers based on high pressure process technology licensed from Japan's Mitsubishi Petrochemical Co. The new catalysts were unveiled on the occasion of the opening of the company's new research facilities near Brussels (Europe), by the President John R. Webb. Although declining to specific the nature of the new proprietory catalysts, he predicted they will lead to a variety of polymers with improved performances features for the automobile, textile, packaging, adhesives, and electrical end-use markets. (*C & EN*, 9/18/89, p. 20).

MOLECULAR SEIVE SENSORS ON THE HORIZON

Zeolite-silica thin films with molecular sieving properties have been prepared and coated on surface acoustic wave (SAW) devices to impart chemical selectivity report researchers of the dept of chemistry, University of New Mexico and researchers at Sandia National Laboratories.

SAW devices are sensitive prezoelectric balance that respond with frequency changes when substances adsorb on their surfaces. Because this response is iron-selective a number of coatings have been explored to impart chemical selectivity. New coating of a SAW device with zeolite silica thin films has resulted in sensors able to detect selective adsorption of organic vapors. Whereas vapors of methanol and propanol adsorb on the film, response of the sensor to iso-octane was minimal because the molecule is excluded by the small pore size of the Zeolite film. 'A striking difference in frequency response to different probe molecules was observed' the researchers report. (*J. Am. Chem. Soc.*, 111, 7640 (1989)) and (*C & EN*, 9/25/89, P. 32).

A NEW STABLE METHYLATING REAGENT

A methylating reagent that is as reactive as lithium dimethylcuprate but that is easier to handle and can be stored at room temperature has been developed at Lithium Corpn. of America, (Bessemer City, North Carolina, USA). The company is now sending research samples of lithium methyl (2-thienyl) cuprate to several parties and may begin commercial scale production in 1990. Research chemist Helen B Hatch made the reagent by treating a toluene solution of the dimethyl sulfide adduct of cuprous bromide with a solution of methyl lithium and 2-thienyl lithium in toluene and tetrahydrofuran. She made 2-thienyl lithium from reaction of thiophene with either methyl -- or butyl lithium.

Solutions lost no active methyl content on storing for 10 weeks at room temperature. This contrasts starkly with lithium dimethylcuprate, which is tricky to make and must be used at once. Hatch's future work includes investigation of such other lithium alkyl (2-thienyl-cuprates as market research indicates may be commercially viable. The Company's first customers will probably be laboratory chemical suppliers for repackaging and sale in small quantities. But the stability and ease of handling of the reagent may lead to the first widespread use of cuprates to make pharmaceuticals, pesticides, flavor and fragrance chemicals and pheromones. (*C & EN*, 9/25/89 p. 40).

A NON-POLLUTING ULTRAMARINE PIGMENT DEVELOPED

Relatively non-polluting technology to make a pigment related to ultramarine (Pigment Blue 29) has been developed by materials science Professor Rosemarie Szostak at George Institute of Technology. The researchers costs a zeolite of proper particle size with sulfur and fires it. Though small amounts of sulfur dioxide are generated, the amount is much less than with the traditional process of firing a mixture of kaolin, soda ash, sulfur and charcoal. The firing temperature in the new process, which George Tech. is patenting, also is lower, resulting in significant savings in energy costs.

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MATERIALS MANAGEMENT

Part X - Inventory and its control (Contd.)

N.R. PAI

EPQ (Economic Production Quantity)

We next come to the second mathematical model employed in inventory control system viz. EPQ (Economic Production Quantity) model. For calculating EPQ four different costs are normally considered.

These are:

1. Production cost
2. Set up cost
3. Holding cost

} per year

and

4. Total annual cost which is the sum of these first three costs.

1. Production cost

It is simple to calculate when annual demand (D) in units and cost of production per unit C are known. Then

Production cost = D x C

2. Set up cost

Since D is the total annual demand in units, then, D/Q = number of production runs per year where, Q = size of the each production run. Now, if set up cost per production run = S then the total set up cost for all the production runs taken together in a year will be,

$$= \frac{D}{Q} \times S$$

3. Holding cost

It is the cost of production produced but not sold and the method of its calculation is discussed later separately*.

4. Total annual cost (TC)

This is then given by:

$$TC = DC + \frac{D}{Q} \times S + \text{Holding cost of unsold production}$$

Total annual = Production cost + Set up cost

Calculations for ascertaining holding cost of production unsold

If, 't_1 = time of production, say 8 hours (1 shift), Q = Quantity produced in time t_1. The rate of production 'rp' is given by

$$rp = \frac{Q}{t_1} \quad \text{-- (i)}$$

Now, If rd = rate of demand for the item by the customer (it corresponds to the rate of sale by the supplying organisation) during time t_1 then rate of inventory accumulation can be given by rp-rd units/hour (i.e. units in unit time provided rp>rd)

Therefore maximum inventory during time t_1 = rate of inventory accumulation (per hour) x number of hours.

$$= (rp-rd) \times t_1 \quad \text{-- (ii)}$$

This argument can be further clarified by the following example: Consider a company producing 100 plastic tumblers per hour, out of which 98 are sold per hour. Then we have, production rp = 100 tumblers per hour and demand (sales) rate rd = 98 tumblers per hour. So, the rate of inventory accumulation (per hour) = rp-rd = 100-98 = 2 tumblers per hour.

Therefore maximum inventory accumulation in one shift i.e. in 8 hours or in time t_1 will be = (rp-rd) x t_1 -- (ii)

= (100-98) x 8 = 16 tumblers.

Now, in general and as seen while developing EOQ model,

$$\text{average inventory} = \frac{\text{Maximum inventory}}{2} \quad \text{-- (iii)}$$

But as per equation (ii) maximum inventory = (rp-rd) x t_1.

$$\text{Therefore average inventory} = \frac{(rp-rd) \times t_1}{2} \quad \text{-- (iv)}$$

Referring to equation (i) we have $rp = Q/t_1$

Therefore $t_1 = Q/r_p$. Substituting this value of t_1 in (iv) we have, average inventory $= \frac{(rp-rd) \times t_1}{2}$ -- (iv)

$$= \frac{(rp-rd)}{2} \times \frac{Q}{rp} \quad \text{-- (v)}$$

For cross check, when rd=0 average inventory becomes $\frac{(rp-0) \times Q}{2rp}$

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* In this article Part XI was printed inadvertantly before Part X.

$$= \frac{rp \times Q}{2rp} = \frac{Q}{2}$$

Now, if H = annual cost of holding one item; then overall holding cost is given by = average inventory H

$$= \frac{Q \times (rp-rd)}{2rp} \times H$$

Therefore total cost TC is given by

$$TC = DC + \frac{DS}{Q} + \frac{Q(rp-rd)}{2rp} \times H \quad \text{-- (vi)}$$

production cost; set up cost; holding up cost (of production unsold)

Now, we want to ascertain that value of Q where TC will be minimum. In other words for EPQ TC should be minimum. To get this value we have to differentiate TC with respect to Q. Now we have from equation (vi)

$$TC = DC + DSQ^{-1} + \frac{Q(rp-rd)}{2rp} \times H$$

On the right hand side only Q is variable and the rest are constants. Thus differentiating TC with respect to Q we have

$$\frac{d(TC)}{dQ} = (-1)DSQ^{-2} + \frac{(+1)Q^{\circ}(rp-rd)}{2rp} \times H$$

$$= \frac{-DS}{Q^2} + \frac{(rp-rd) \times H}{2rp}$$

Now, for TC to be minimum $\frac{d(TC)}{dQ} = 0$

i.e. $\frac{-DS}{Q^2} + \frac{(rp-rd) \times H}{2rp} = 0$

Therefore $\frac{DS}{Q^2} + \frac{(rp-rd) \times H}{2rp}$

Invert L.H.S. and R.H.S.

$$\frac{Q^2}{DS} = \frac{2rp}{(rp-rd) \times H}$$

Therefore $Q^2 = \frac{2rp \quad DS}{(rp-rd) \times H}$

Therefore $Q = \sqrt{\frac{2rp \quad DS}{(rp-rd) \times H}}$

Where Q = Economic Protection Quantity (EPQ). It is worth noting that this model assumes that stock out situation does not arise i.e. rp>rd and again (rp-rd) = negligible quantity.

To get fixed in mind the concept of EPQ and to unders the practical applicability of this model we can go in fo following problem to be solved by EPQ formula.

A company manufactures a particular product which an annual demand of 30,000 units. The rate of produc of this product is 120 units a day, and the cost of manu turing each unit is Rs. 40. In a year the company works 300 days. The set up cost per production run is Rs. 18; w the yearly holding cost works out to Rs. 9 per unit. With data we have to calculate EPQ as also the number of duction runs per year.

Assigning our usual denotations for ease of working have:

1. Annual demand in units = D = 30,000 units.
2. Cost of production per unit = C = Rs. 40.
3. Set up cost per production run = S = Rs. 18.
4. Production rate = rp = 120 units a day.
5. Holding cost per unit per year = H = Rs. 9.
6. Size of production run = Q (EPQ) to be calculated.

Here, production rate is given in terms of units per while demand rate is given on yearly basis. To bring th on the same scale we convert demand rate in terms of u per day as follows:

Demand per year is 30,000 units and since there are 300 wo ing days in a year rd (demand rate per day) = 30,000/ = 100. Now, applying the formula we have,

$$EPQ = \sqrt{\frac{2rp\ DS}{(rp-rd) \times H}}$$

$$= \sqrt{\frac{2 \times 120 \times 30{,}000 \times 18}{(120-100) \times 9}}$$ (By value substituti

$$= \sqrt{720000}$$ (on solving)

= 848.5281 (on solving).

= 849 or say 850 in round figures.

Number of production runs will be given by D/EPQ = 30000/850 = 35.294 or say 35.3.

However, if 900 is chosen as a convenient number for E using human judgement, then the number of production r work out to 30,000/900 = 33.33.

Back ordering

Sometimes demand for a product manufactured by organisation is in excess of that which is planned. In su cases, generally the shortfall in the supply of the product to be met with by the supplier. He then solves his proble

by meeting this shortfall from the following production run. This method of supplying shortfall in the items from the subsequent production run is known as back ordering. Now, this back ordering incurs additional expenditure to the organisation. However, it keeps up the patronage of loyal customers. Again the sale of the organisation is not lost even if it faces temporary stock out situation, with respect to its products manufactured. Back ordering, however, is possible only with patient and loyal customers. It is a necessity in case the product is a monopoly item. In the previous case customer prefers to wait till he is served from the next production run against his outstanding orders, rather than switching over to another supplier.

When the cost associated with back ordering is worked out accurately, corresponding EPQ can be computed by applying the following modified form of this mathematical model.

$$EPQ = \sqrt{\frac{2rp\ DS}{(rp-rd) \times H}} \times \sqrt{\frac{H+K}{K}}$$

Here, K stands for the cost per unit per year associated with back ordering. Now, if in the above examples back ordering cost per unit works out to Rs. 6 i.e. K = 6, then by substituting the value of K in the above formula we get,

$$EPQ = \sqrt{\frac{2 \times rp \times D \times S}{(rp-rd) \times H}} \times \sqrt{\frac{H+K}{K}}$$

$$= 849 \times \sqrt{\frac{9+6}{6}}$$

$$= 849 \times \sqrt{5/2}$$

= 1341.42 units (on solving).

Note that we have already calculated value of

$$\sqrt{\frac{2 \times rp \times D \times S}{(rp-rd) \times H}}$$

which works out to 849.

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Science Briefs

FIRST BIRTH CONTROL VACCINE FOR MEN

The world's first birth control vaccine for males, developed at the Indian Institute of Science (IISc), is now ready for the phase of human trials.

"Our tests on monkeys have proved the vaccine to be absolutely safe, effective and reversible," Dr. N.R. Moudgal, head of the Centre for Advanced Research in Reproductive Biology, at IISc, Bangalore, said.

"It can now be put through the crucial phase of human trials," Dr. Moudgal said to the press.

The vaccine works by blocking the action of a hormone called follicle stimulating hormone (FSH) which is essential for sperm production and fertility. Blocking FSH induces infertility.

In trials on bonnet monkeys at IISc, when male monkeys immunised with the vaccine were mated with fertile females, no pregnancies resulted, Dr. Moudgal said.

The Indian Council of Medical Research has cleared the protocols for the first phase of human trials in which the safety of the vaccine will be tested on male human volunteers.

The vaccine is an offshoot of basic research on hormones at IISc initiated more than a decade ago. In the late 1970s Dr. Moudgal's group showed that blocking FSH action induced infertility in monkeys.

The find was independently confirmed by research centres in the United States and West Germany. The results of their tests with monkeys have also been validated at the National Institute of Health and Family Welfare in New Delhi. The vaccine which is made from FSH obtained from sheep stimulates the production of antibodies to the FSH. These antibodies react with the natural FSH and induce infertility.

The vaccine has no effect on male libido and is totally reversible. Dr. Moudgal said. After the injections are stopped, the sperm count goes up and the animals became fertile again.

Their tests on the monkeys indicate that for effective vaccination, three to four injections would be required during the first year and less than two per year subsequently.

ANCIENT HERB IS ANTI- GERMICIDAL, ANTI- INFLAMMATORY

An ancient herb dating back to the Atharvaveda has recently been confirmed to possess anti-bacterial, and anti-inflammatory properties.

The rhizomes of the herb, Acorus calamus, commonly known as sweet flag, which find mention in ancient Ayurvedic texts, are reputed to be effective in the treatment of mental ailments like insomnia, melancholia, neurosis, hysteria and loss of memory. Scientists have already extensively studied the herb for its effects on the central nervous system and isolated two active substances, alpha and beta asarone, from it. It has also been attributed with germicidal properties.

Scientists at the Institute of History of Medicine and Medical Research, New Delhi, prepared an extract of crude dried roots of Acorus calamus in ethanol and concentrated it to form a crude drug material which they referred to as AC-1. Using albino rats and mice, the team studied the effects of the crude drug on various Gram-positive and Gram-negative bacteria and as an analgesic and anti-inflammatory agent.

AC-1 in concentrations of 0.05 to 0.1 ml per ml, exhibited "fairly moderate" anti-bacterial activity, and the effect was more evident against Gram-positive bacteria, a report of the scientists' findings in the "Annals of the National Academy of Medical Sciences" says.

It was also found to possess "significant" anti-inflammatory activity in cases of arthritis, oedema and granuloma in the experimental animals.

But the drug did not show any analgesic or anti-pyretic action, the report by Dr. S.B. Vohra and co-workers in the journal said.

The study confirms the germicidal property attributed to this drug in ancient Ayurvedic texts and gives a rational basis to claims of its efficacy in treating inflammatory conditions in Unani medicine.

GRAPHITE TAPE/SHEET FROM NATURAL GRAPHITE

The National Physical Laboratory (NPL), New Delhi, has developed the know-how for the manufacture of graphite tape or sheet which can replace asbestos as a sealing agent for gaskets and packings.

Graphite tape/sheet is a binderless product obtained by compression of exfoliate graphite material particles.

NPL has developed flexible graphite from natural graphite obtained when treated flakes are washed with water and dried. The soggy treated flakes are then heated to a suitable temperature which make them expand in the direction upto 30 times that of the original sample thickness. The end product is then pressed into a foil which is flexible in nature.

The exfoliated graphite is impermeable to gases and liquids and is a good sealant. It is temperature resistant and can be used from minus 200 degrees to 500 degrees Celsius in an oxidising atmosphere and upto 3000 degrees

Celsius in an inert or reducing atmosphere. It is not wetted with flasos or metals and does not age or creep. The product is self-lubricating, easy to cut and punch and resistant to radiation and corrosion.

At present, it is being imported, but demand for it is expected to increase with indigenous production. The cost of production is only Rs. 800 per kg. says a report in "Invention Intelligence".

BLUE DUST -- A PRECIOUS MINERAL

Big pockets containing blue dust, a precious mineral have been found in some mines of National Mineral Development Corporation (NMDC) in Bailladila.

Blue dust, which is very rich in iron, can be used to produce sinter for use in the blast furnaces of the integrated steel plants in India. It can replace 10 per cent of the fines in the production of sinter. Industrial applications of blue dust in powder metallurgy, electronic industry and welding industry are also under study.

According to NMDC authorities, the reserves of blue dust in Bailadila-14 are expected to be about 22 million tonnes. Research and development by NMDC has established that blue dust which is pure iron combined with oxygen can be used in the manufacture of iron powder in powder metallurgy and making spare parts of automobiles.

It can also be used in the manufacture of electrodes of heating pads for use in high altitude areas by the army, high quality brake pads for the aircrafts and cold rolled grain oriented sheets.

In electronic industry, blue dust has been found suitable for manufacturing hard and soft ferrites and magnets. Blue dust pellets can be directly used in electric arc furnaces for manufacturing steel. With more research, blue dust can replace metal scrap or sponge iron as a raw material for the steel industry.

Some Japanese steel mills have shown keen interest in purchasing blue dust from India. A 3,000-tonnes-per-year demonstration plant for manufacturing beneficiated blue dust is being set up at Bailadila to manufacture ferric oxide. NMDC not only hopes to meet the demand of the ferrite industry in India but also export ferric oxide to South-East Asian countries. NMDC will soon set up a pilot plant for manufacture of iron powder.

CSIR POLYTECHNOLOGY TRANSFER CENTRE

The CSIR Polytechnology Centre in Hyderabad has emerged as a focal point amongst entrepreneurs, promotional agencies, research and development institutions and government departments during its 14 years of existence.

Set up in 1975 as a Polytechnology Clinic to carry out diagnostic studies on industrial problems, it slowly expanded its scope of activities to include transfer of technologies and assistance for entrepreneural development. It also aims to create awareness about science and technology as a vehicle for industrial developlment and solve industrial problems with the help of expertise available both within and outside CSIR.

During the last four to five years, PTC helped to transfer the vertical shaft kiln (VSK) technology for manufacturing cement, developed by the Regional Research Laboratory, Jorhat, to Andhra Pradesh. Today, four tiny cement plants are in operation, two in Guntur district and one each in Ananthapur and Mahboobnagar, while about ten more are being set up. PTC has kept in touch with the manufacturing units to ensure the quality of the product and help overcome technical problems.

Similarly, PTC has helped an entrepreneur in Andhra Pradesh, a state with extensive deposits of high-grade stone, to set up a unit for precipi calcium carbonate, based on tech gies developed at the Central Sal Marine Research Institute (CSM Bhavnagar, and the Central Bui Research Institute, Roorkee.

A wide variety of industries benefitted from the assistance ren by the centre, while new units, in ing factories for making pH an selective electrodes, are springing many parts of the state.

Through active collaboration w CSIR laboratory, the National Res Development Corporation and a f cial agency, PTC has helped to s a plant in Nalgonda district for ma red iron oxide pigment, the only o its kind in Andhra Pradesh.

With a plant to manufacture ele lytic manganese dioxide (EMD important constituent of dry batt ready for the first phase of produc PTC has played a crucial role in i ducing EMD to the state.

Plant-based industries are also b ning to flourish with PTC's help entrepreneur in Srikakulam distr planning to set up a unit based on know-how for the manufacture of agar, a sea weed extract from sel species of red algae, which is us many textile and cosmetics indus Cultivation of jojoba, whose seeds tain 50 to 60 per cent liquid wax v is of immense industrial value, is i gress. A number of fruit and food cessing units relating to instant and fruit bars, dehydration of grape bottling of coconut water have co in the state with PTC's encourage

Other technical units set up PTC's help deal with pesticides chemicals, aluminium alloys, merged arc welding flux, insu bricks from rice husk ash, wire w resistors and geoinstruments groundwater and mineral survey

The centre has also attempted to solve a number of technical problems. For example, one of the most important problems solved by the centre is cost reduction for aluminium utensil manufacturers in Rajahmundry. A survey made by the centre showed that improved furnace oil burners when incorporated into the system, reduced the cost of fuel by nearly 20 per cent. A few units have already adopted this improved technique.

PTC arranges meetings between experts, consultants, entrepreneurs and industries to solve specific problems attends to the revival and rehabilitation of sick units, and helps in modernisation and upgradation.

PTC conducts its activities under the overall guidance and advice of a high-powered Advisory Committee headed by the Secretary, Industry and Commerce, Government of Andhra Pradesh, with representatives from industries, banks, promotional agencies, CSIR, government departments and voluntary organisations. The state government, through its Directorate of Industries, has been providing half the funding to PTC since its inception.

SOLAR HYDROGEN: MOVING BEYOND FOSSIL FUELS

Recent technological advances may soon bring one low-polluting, renewable option -- solar-generated hydrogen gas -- within reach to reduce the use of fossil fuels, according to the World Research Institute (WRI).

The environmental and economic consequences of fossil fuel combustion are being felt increasingly on local, regional and global scales. Deteriorating urban air quality, forest and crop losses, the acidification of lakes and changing global climate are interrelated consequences of fossil fuel use that are requiring policy makers to rethink energy and environmental policies. In addition there is a continued dependence on imported oil.

Foremost among the proposed remedies to reduce pollution and ease foreign oil dependence are actions to cut the use of fossil fuels in national energy diets and replace them with cleaner domestic energy supplies. Many such alternative energy sources have been proposed that address the environmental problems in whole or in part, including methanol as substitute for oil in transportation, and nuclear and solar power in place of coal in generating electricity, though not all of these choices are ideal replacements. Methanol and nuclear power are fraught with pollution, safety, and security concerns of their own.

The sun represents an ideal source of energy: clean and virtually limitless, says Washington-based WRI in the report. But, even with the advances in solar heating and electricity technologies in the 1970s, solar energy has still found only limited applications. The primary obstacles have been the high costs of producing and storing electrical energy. Solar cells can make electricity only when the sun is shining, so the problem remains of maintaining a continuous supply of electricity yearlong and around the clock, even on cloudy days.

One ideal means of addressing this problem is to store and transport solar-generated electricity in the form of hydrogen. When electricity from a solar cell (or any other source) is passed through water, the water molecules are split into their constituent parts —hydrogen and oxygen — in a chemical process known as electrolysis. The resulting hydrogen gas can then be shipped through pipelines and burned to produce heat, much like natural gas, or used to power slightly modified vehicle engines. Hydrogen is also an important industrial chemical used in the manufacture of agricultural fertilizers, hydrogenated food oils and fats, and other industrial chemicals

What makes hydrogen worth reconsidering for the 21st century is that solar photovoltaic (PV) technology is becoming cheap and efficient enough to make hydrogen competitive with synthetic fuels derived from coal. It is also preferable to other alternative fuels because it is one of the cleanest fuels available. This means that in the sunnier regions of the United States, the direct current (DC) electricity needed to produce hydrogen could be available by the turn of the century at affordable prices (2 cents to 3.5 cents per kilowatt-hour).

Hydrogen is an exceptionally clean-burning fuel -- cleaner than today's fossil fuels or proposed fossil fuel-based synfuels such as methanol made from coal or natural gas. The combustion of hydrogen emits no carbon monoxide, volatile organic compounds, or particulates, which contribute to urban air pollution, and no sulfur dioxides, a primary cause of acid precipitation. Indeed, burning hydrogen releases only water and a single pollutant, nitrogen oxide, which can be controlled successfully to very low levels.

PV hydrogen is also one of the few long-term energy supply options that can meet the world's energy needs without contributing to the green-house effect. Since no carbon dioxide is emitted during production or combustion, PV hydrogen has a decided edge over synfuels, such as methanol, which are currently being considered as alternatives to gasoline. Even if methanol lived up to its claims for improving local air quality, it would still release significant quantities of carbon dioxide and a massive shift to coal-based methanol would exacerbate global greenhouse warming.

PV hydrogen is also not constrained by the same resource limitation worries as are oil, natural gas, or uranium because it is based on renewable resources -- water and sunlight -- and on abundant raw materials -- silicon from ordinary sand in the case of amorphous silicon thin film cells. Moreover,

enough PV hydrogen to meet the entire fuel requirements of the United States could be produced on only 1 per cent of the US land area.

Another noteworthy advantage of PV hydrogen is that it does not require billion-dollar capital investment, as fossil fuel-based synfuel or nuclear power plants do. In fact, the capital investment needed to bring a 5 to 10 megawatt PV hydrogen plant into being is only four million to 12 million dollars.

The case for hydrogen is persuasive on economic and environmental ground, but is it safe compared to other common fuels? The very properties that make most fuels useful -- the capacity to store a large amount of readily accessible energy in a small volume -- also make them potentially dangerous. Hydrogen is no exception, but its physical properties indicate that it poses no more of a danger than natural gas or gasoline.

The first market for solar hydrogen may be the chemical industry. Currently, industrial hydrogen is made primarily from natural gas. As affordable, modular PV units come onto the market, low-volume users in sunny areas could begin generating their own hydrogen supplies in the early 1990s and the rest of the industry could begin to use solar-generated hydrogen by the end of the decade.

Chemical markets will play a decisive role in the early development of PV hydrogen, but the major environmental benefits will accrue only when hydrogen penetrates transportation energy markets. Research and development for hydrogen-powered vehicles is already under way in Germany and Japan, and these vehicles could be commercially available over the next decade.

Projected advances in solar technologies indicate that PV hydrogen could become roughly cost competitive with synthetic fuels derived from coal or other sources by the early part of the next century. But energy planners have yet to look seriously at solar hydrogen as an alternative energy source for several reasons. First, the prospect of dramatic advances in thin-film solar cell technology has become clear only recently.

Second, low world oil prices have kept energy issues off the public policy agenda during the last few years, so that policymakers and the public generally are unaware of the spectacular technical and economic progress being made in the PV industry. And third, even within the PV research and development community, efforts have been focussed on the nearer-term PV electricity markets rather than on longer-term PV hydrogen markets.

As the environmental evidence against fossil fuels mounts, local and national governments are searching for ways to reduce urban air pollution, halt acid rain and stem the build up of green house gases in the atmosphere. The most promising, long-term solution is to reduce our dependence on traditional fossil fuels through energy efficiency improvements and a shift to alternative fuels that create little or no pollution.

Because hydrogen contributes much less to air pollution than these other alternatives and could become available as a transport fuel in the near future, PV hydrogen should be a part of any clean air plan.

While the United States began work on these hydrogen technologies in the 1970s, little is being done today. Hydrogen-powered vehicles, space and water-heating systems, home car-refuelling systems, and fuel cells warrant high research and development priorities. Similarly, rant high research and development PV hydrogen systems have been built and a number of conceptual designs for large plants have been developed, but until the recently proposed 600-kW Solar Wasserstoff project in West Germany, there have been no large demonstrations of hydrogen systems.

TURNING WASTES INTO COM POST

A new, mobile compost-turni machine combines sewage and straw create a nutrient-rich compost, says t journal "The Futurist". The Briti complanies that developed the new pr cess say the resulting compost is odou less, free of pathogenic organisms, a full of organic matter, making it ide for use in plant and tree nurseries a in land reclamation. According to t journal, the process can also be appli to such waste as cotton husks, alfal grass, sugar cane, and residue from wi pressings.

NEW PLASTIC WITH UNIQUE OPTICAL PROPERTIES

AT & T scientists have created fundamentally new class of plastics wi unusual properties that may have nov uses in electronics and optics. The ke ingredient in the novel plastics is sil con, a departure from familiar plastic which are based on carbon. In the ne material, called polysilanes, the silico atoms are linked together in irregula networks of fused rings. These network give the plastics their special propertie

"Their unique combination of opt cal properties and chemical sensitivit to light make polysilanes more tha laboratory curiosities," said Timoth Weidman, the AT & T Bell Laborator ies chemist responsible for the synthe sis of the materials. Already the plastic are being used to explore a new tech nology for making optical waveguid connections, tiny channels that carr light pulses in much the same way tha metal connections conduct electricity

"Optical connections may hav numerous advantages for high-densit and high-speed transmission," sai Larry Hornak, an AT & T Bell Labor atories scientist exploring optical inter

nnection strategies for integrated dig- l systems. "Polysilanes accelerate our search by allowing optical waveguide uctures to be prepared in minutes stead of days." Their special qualities so may make polysalynes potentially ractive for such applications as opti- l computing and integrated optical gnal processing, the newsletter said.

ACTERIA FOUND TO EAT UP OXIC CHEMICAL

Scientist at General Electric's esearch and Development Centre at ew York have discovered two new rains of bacteria that "feast" on PCB, class of toxic chemicals so far thought be indestructible, says the journal Omni". The PCB (polychlorinated iphenyls) - eating bacteria are not the rst organisms known to metabolize the hemical but they are easily the most voracious, the journal said.

The new bacteria, discovered while combing through PCB-affected soil, devour more than 90 per cent of one of the most common PCB mixtures, and the scientists hope to harness purified strains and make them more viable. Developed in the 30's, PCBs were banned in 1979. An estimated 440 million pounds of PCBs have found they their way into the environment through illegal dumping and leaking electrical transformers, Omni said. At present, the PCBs can only be destroyed through costly high-intensity incineration.

POWER FROM COW DUNG

The first commercial power plant that uses cattle dung as fuel is now fully operational in the United States. Situated near El Centro, California, the Mesquite Lake Resoure Recovery project generates 17.5 MW per hour -- enough to power 15,000 homes -- and sells most of it under a 30 year contract to the town of Edison in Southern California.

Each day the plant collects 900 tonnnes of manure at one dollar a tonne from nearby feedlots. The odoriferous carbon-rich dung is dried for two to three months under the sun before it is burned at 1500 degrees Fahrenheit to power the plant's steam turbines.

A former real estate agent, William Parish, who owns and manages the plant, eventually hopes to sell the ash left over from the process for possible use in road building or absorbing toxic wastes, the U.S. release said.

-- (all items) P.T.I. Science Service, Jan. 1-15, 1990.

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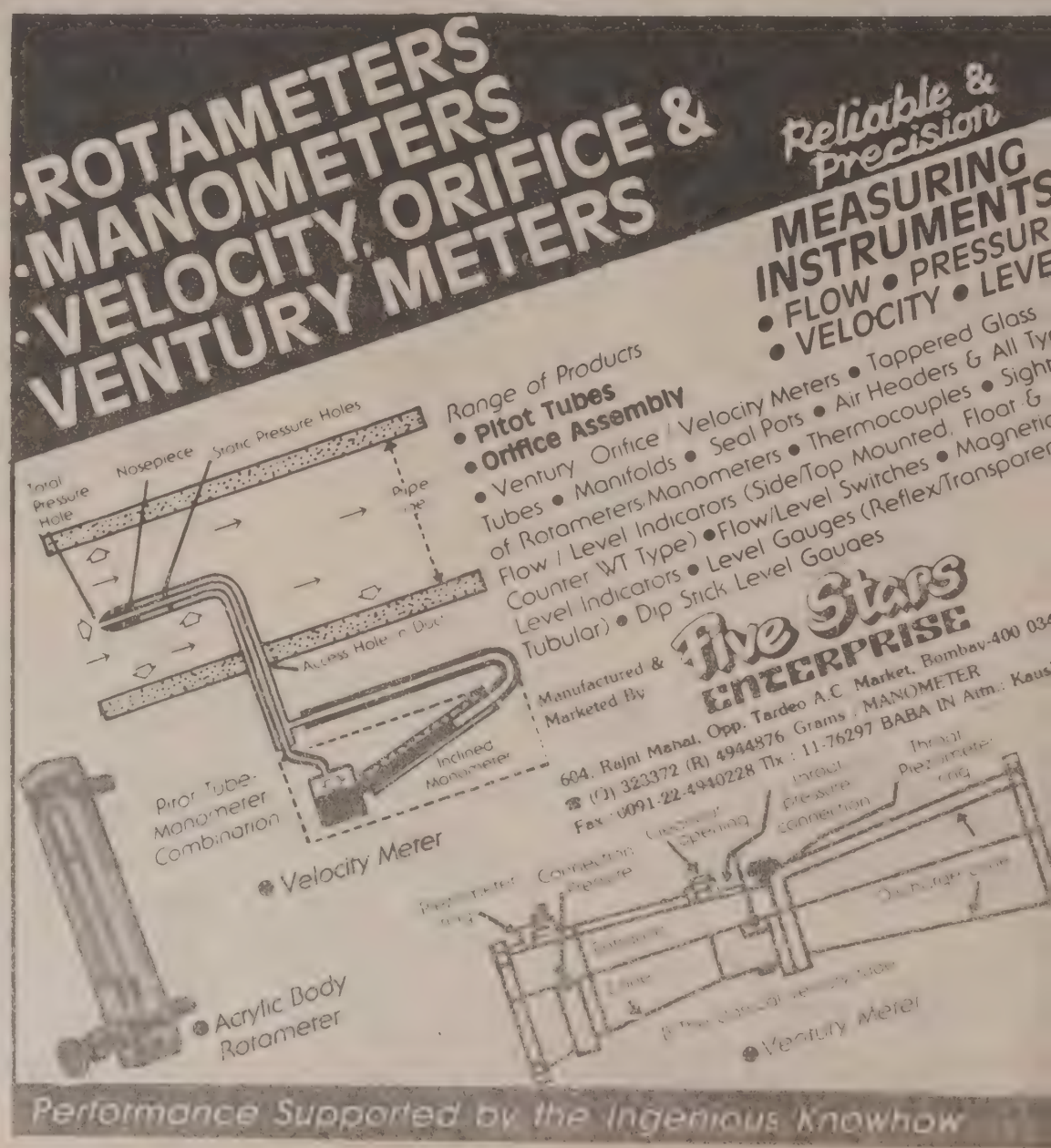


New products

BLOOD ANALYSIS EQUIPMENT

The Central Scientific Instruments Organisation (CSIO), Chandigarh, has developed a blood analysis equipment for estimating the various blood parameters like glucose, urea, albumin and proteins for clinical diagnosis. Such equipment are needed in large numbers to adequately equip the country's primary health centres. The blood analyser is essentially an absorptionmeter, colorimeter or spectrophotometer depending upon the accuracy required. Basically, it consists of a source of radiant energy, a device to get monochromatic light (filter), a sample holder, a detector to convert the light into an electric signal and a display device. The source of visible light is generally a tungsten lamp which has a limited life.

The equipment developed at CSIO has solidstate light sources which have infinite life and emit light at 565, 583 and 635 nm. The use of these sources not only solves the problem of limited life of the tungsten lamp but also eliminates the use of filters. The equipment makes use of those blood chemistries which give peak response at these three wavelengths. The liquid crystal display fo the transmitted light helps reduce the power consumption and the equipment can be operated on batteries.

The invention has fetched Mr. Ragbir Singh Khandpur, Ashok Kumar Bhandari and Sarup Singh Randhawa of CSIO a National Research Development Corporation (NRDC) award of Rs. 30,000 jointly. The CSIO system permits analysis of 60 blood samples per hour and the results are displayed on a printer in the form of sample number and concentration. The results are also plotted on a calibrated chart. The system is based on the principle of continuous blood flow analysis. The basic modules of the system are a sampler, a manifold proportioning pump, heating bath, colorimeter and computer and recorder. The reactants are pushed through different flow lines in the required proportion and mixed in the manifold where the reaction takes place. The actual quantitative measurements are made in the double beam colorimeter in a sequential manner for the required parameters. The estimated cost of production is Rs. 2 lakh per unit.

INFRA-RED SWITCH

A cost-effective and multi-purpose Infra-red switch from Innosys is now available. The working principle of the infra-red 'through scanner' model is simple. An invisible infra-red beam passes between a transmitter and receiver. When this beam is broken, it emits a signal. Its applications are varied. When connected to an intruder alarm, it can serve as a highly effective security measure. Especially for banks, jewellery stores, R&D department, godowns, etc., after closing hours. By itself, it is a reliable counting apparatus. And excellent for ensuring operator safety where hydraulic presses, etc. are employed.

The Innosys infra-red 'reflective' model, suitable for position sensing of machinery, controlling of paper roll sizes, detecting web-breakage in textiles, regulating the automatic opening/-closing of lift doors, etc. will also be soon available in the market. There are many more ways in which infra-red switches could be used. For details contact: Innosys Electronics & Systems Pvt. Ltd., 174/A2 Shah & Nahar Industrial Estate, Dhanraj Mills Compound, Lower Parel (W), Bombay 400 013.

LASER LIGHT SCATTERING SPECTROPHOTOMETER, THE DLS-700

The PL Separation Sciences Division of Polymer Laboratories is pleased to announce an addition to its product line - a laser light scattering spectrophotometer, DLS-700, from Otsuka. This instrument provides a precise, fast and easy way of obtaining molecular weight and size information from molecules in solution.

The DLS-700 can be operated in one of two modes, namely dynamic light scattering and static light scattering.

In the dynamic mode, fluctuations in the scattered light intensity are monitored as a function of time. The time scale of these fluctuations, conveniently analysed using autocorrelation techniques, yields values of diffusion coefficients and particle size. Size distributions for monodispersed samples are rapidly obtained by unimodal analysis.

For more complex systems on-line multimodal size analysis provides good resolution of individual species in polydispersed samples. Particles in the size range of 3nm to 3 microns can be analysed by the DLS-700.

In the static light scattering mode, measurements are made on the total intensity of scattered light as a function of both angle and concentration. Manipulation of the data is achieved, through the software, by utilising the Zimm, Berry or Debye plots giving absolute molecular weight, second virial coefficient and radius of gyration.

An angular range of 5 to 150 degrees coupled with high sensitivity allows accurate determination for a wide range of molecular weight, 300 to 20,000,000 daltons.

The dual capabilities of the instrument mean that the DLS-700 offers complete size characterization for a wide range of molecules.

For further details contact: The Publicity Manager, PL Separation Sciences, Polymer Laboratories Ltd, Essex Road, Church Stretton, Shropshire SY6 6AX, Phone: 0694 723581. Fax: 0694 722171.

PRODUCT REVIEW:

Sodium Sulphide

S. GANAPATHY*

Introduction

This versatile is widely used in the following:

(1)Tanneries -- one of the largest consumer of Sodium Sulphide for the dehairing of skin and hides. India is exporting large quantity of processed leather.

(2) Paper Industry -- In the Kraftwood pulping process, sulphide is used in the cooking liquor.

(3) Dye and Dye Intermediates.

(4) Drug and Drug Intermediates.

(5) In the manufacture of Soda Ash, Metallic Zinc etc.

(6) Polysulphide elastomers, ore floatation, certain lube oil etc. The demand for this product has been quite encouraging in the past and in the present.

Manufacture:

Some of the various routes of manufacture are as under:

(1) From Sodium Sulphate:

During the manufacture of rayon and sodium bichromate, sodium sulphate is produced as by-product -(around 900 Kg. per tonne of rayon/bichromate). Similarly in the manufacture of Vitamin C (from dextrose) sodium sulphate is a by-product. Reduction of anhydrous sodium sulphate with carbon or with other solid organic material or with hydrogen or hydrocarbon gases, gives sodium sulphide. Generally carbon is used as the reducing agent the reaction is normally carried out at 700-900°C, depending upon the type of carbon used, and the type of furnace etc. with pine charcoal. The reaction begins at 750°C but with graphite, petroleum coke a temperature up to 850° -- 880°C is needed. The following reactions take place in the reduction furnace.

$$Na_2SO_4 + 4C \longrightarrow Na_2S + 4CO \uparrow$$

$$Na_2SO_4 + 2C \longrightarrow Na_2S + 2CO_2 \uparrow$$

In the reaction carbon gets oxidized to CO or to CO_2 according to the furnace conditions and proportions of the reagents - Sulphate and carbon. If the temperature is too high SO_2 also is produced. The reduction reaction is assisted by the use of a flux such as Na_2S or the sulphides of another metal. The above reduction reaction can be carried out in a stationary furnace (eg. reverberatory type) or in a Rotary Furnace - batch wise or in a continuous way through suitably sized rotary kilns. Producer gas, natugal gas, fuel oil etc. can be used as fuel for the furnace. As the furnace has to be operated under a totally reducing atmosphere, excess air supply or outside air entry into the furnace has to be totally stopped or controlled, by the proper monitoring of O_2 and CO in the furnace off gases. O_2 should be nil in this and there should be at least 1 - 2% of CO. In batch rotary or reverberatory Furnaces, reduction of the batch is usually completed in 1 3/4 hr to 2 and a half hrs. when operated properly. The proportion of sodium sulphate and carbon for the maximum/best yield are reported as Na_2SO_4: C = 4:1 or 3:1. Increase in proportion of carbon decreases the loss of sulphur but increases other undesirable reactions so that the yield, ultimate, of sulphide is not increased but decreased.

Sulphate reduction reaction is diffusion controlled and hence the Sulphate and carbon must be below 20 mesh and intimately mixed before charging to the reduction furnace. Briquetting the charge also favours yield. The roast from the furnace after the completion of the reduction reaction - as confirmed by the (i) appearance of the roast inside the furnace (ii) analysis of a sample for sulphides (The roast has a tendency to stick to the walls of the furnace towards the end of the reduction process) is discharged for its further processing.

It is possible to achieve 60-75% conversion in the furnace. Roast is bleached with hot water (or water and live steam), and treated to remove the unreacted sulphate, carbonate (if any formed) and filtered to get clear solution of sodium sulphide. This is further concentrated to 58 - 60/62% in coal or oil fired evaporaters, and packed as solid, pellet, or flaked and packed.

(2) From Black - Ash (Barium Sulphide)

Barium salts are manufactured from mineral barytes as above. Barytes on carbon reduction gives black ash or barium sulphide, which is processed as below for sodium sulphide.

(i) Reaction between barium sulphide solution and soda ash gives barium carbonate and sodium sulphide. The solution of sulphide of sodium so obtained is filtered from barium carbonate, evaporated in single or double stage to get solid sodium sulphide. Here once can get up to 58 per cent sulphide by proper process control. Ba CO_3 has good market.

$$Na_2CO_3 + BaS \longrightarrow BaCO_3 + Na_2S$$

$$Na_2SO_4 + BaS \longrightarrow BaSO_4 + Na_2S$$

* 14/276, Tata Co-Operative Building, Sion (East), Road 31, Scheme 6, Bombay 400 022.

(ii) Alternately black ash is reacted with hydrochloric acid in a closed reactor and the hydrogen sulphide gas produced in the reaction as detailed below:

$$BaS + 2HCl \longrightarrow BaCl_2 + H_2S \uparrow$$

is dissolved/absorbed in caustic alkali to produce Na HS, which is further neutralized by additional caustic soda to produce Na_2S. The barium chloride has very good market.

3. From H_2S:

In case of availability of H_2 S from neighbouring units or from one's own unit, this can be absorbed in caustic Alkali to finally give Na_2 S as under:

(a) $NaOH\ H_2S \longrightarrow NaHS + H_2O$

(b) $NaHS + NaOH \longrightarrow Na_2S + H_2O$

$$2\ NaOH + H_2S \longrightarrow Na_2S + 2H_2O$$

This process will give good quality Na_2S and one can even achieve upto 62% quality in the final product easily.

4. From caustic soda and sulphur:

Sulphur, as fine powder, when dissolved in excess 48/50% alkali solution at its boiling point, in the presence of little polysulphides or some selected catalysts gives mainly sodium sulphide. The reaction generally is as under:

$$12S + 6NaOH \longrightarrow 2\ Na_2S_5 + Na_2S_2O_3 + 3H_2O$$

As can be seen from the above reaction the final product reaches upto 50 - 53% assay only. At the current prevailing price of caustic soda, the economics of the above process is poor. However there are some manufacturers in the S.S. sector, located in backward areas, following this manufacturing route.

5. From Sodium amalgam of mercury cells:

Poly sulphide of sodium is reacted with the amalgam, (part of it) from mercury cells, to get Na_2 S as a solution, which is further processed to produce flakes, pellets or bits. One can produce totally iron free straw coloured sodium sulphide by doing all the processing of sulphide in nickel vessels. M/s. Travancore Cochin Chemicals Ltd. at Alwaye, Kerala, is producing sodium sulplhide by this way.

At 18°C

Sp. Gravity	% Na_2S
1.02	2.00
1.056	5.03
1.110	9.65
1.158	14.00
1.182	16.20
1.216	18.16

Crystallises beyond this.

	Sp. Gravity	
% Na_2S	30°C	40°C
10	1.10	1.09
12	1.118	1.115
14	1.136	1.134
16	1.160	1.155
18	1.18	1.175
20	-	1.196
22	-	1.216
23.25	-	1.228

Red or Red brown colour is due to iron in sulphide. I free material is pale yellow coloured. If polysulphides present, Na_2S has strong yellow colour.

Properties:

Sodium sulphide is rapidly oxidised by moist air. Li accelerates oxidation by moist air. Hence it is necessary keep storage tanks and drums of sodium sulphide closed a tight as far as possible. Oxidation in solution of sulphide thiosulphate, sulphite etc. is accelerated by metals like Co, Mn, Zn etc. Fe (OH) oxidizes it to Na_2SO_3 in solutio Hence long storage in M.S. tanks to be avoided.

Addition of glycerol in small quantities inhibits oxidati in solution. Fused sulphide attacks gold, silver platinum e But has no action on graphite. Burns of sodium sulphide ta a long time to heal. It should not be handled by bare han as the skin and nails are attacked by the sulphide. It is no inflammable, non explosive and non-combustible. Crysta of $Na_2S.9H_2O$ separates out from the concentrated solutio loses most of the water below 100°C, but one mole of H_2 per mole of Na_2S is not lost readily. With sulphur sodiu sulphide forms Na_2S_4, sodium tetra sulphide.

% Na_2S	Boiling Point °C
25	110
30	115
35	126
40	130
45	140
50	150
55	158
60	168
63.8	176

Production and demand:

The major producers in the organized sector are current producing around 8000 tonnes per year, the production bein hit by erratic power supply and power cuts. Demand, cu rently is estimated around 12,000 tonnes per annum an expected to go up to 14,000 tonnes by end of 1990/91. A present there is a sizable gap between production and deman A 3 tpd unit based on sodium sulphate process requires a approximate investment of 16.00 lakhs.

Risk Evaluation and Insurance

ROBERT W. ROBINSON, MA, CEng, MIChemE,
Oil and Energy Engineering Division, Sedgwick International Ltd., London U.K.

1988 was a year in which the world witnessed several devastating industrial incidents resulting in damage to expensive property and a sensitive environment, the interruption of profitable business activities and most distressing of all the loss of precious lives. The stark statistics relating to three such oil industry incidents in 1988 can be summarised as given in the Table 1.

One might be forgiven for thinking that 1988 was an unusual year, an act of nature, a coincidence. It was not. Both the recent and more distant past are littered with similar stories. To an engineer in the risk control profession, many of these incidents are engraved on the mind. 1987, Pampa, Texas — a major explosion at a petrochemical plant caused US $184 million damage, 3 fatalities and a prolonged shutdown. 1986 gave to the world the Chernobyl nuclear reactor disaster. In 1984 one of the worst industrial disasters ever to have occured resulted in the destruction of an LPG storage depot in Mexico worth US $21 million with the loss of over 500 lives. To most of the world the events on that horrific day were actually eclipsed two weeks later by a disaster in human terms of even greater proportions: Bhopal.

After such a devastating collection of experiences, the extra terrestrial observer might think we should have learnt from these mistakes and that man could look forward to a safer less damaging and more profitable future in the 1990s.

However, engineers sitting in 1979 had the benefit of learning from the catastrophies which struck during the 1970's at:

Seveso, Italy July, 1976.	Description:	Release of highly toxic gas (dioxin) from a petrochemical plant resulting in injuries and illnesses to many inhabitants in surrounding areas.
Flixborough, U.K. June, 1974.	Description:	Failure of 20" by-pass line led to release of cyclohexane which ignited. The explosion destroyed the plant.
	Property Damage:	US $378 million (1988) basis.
	Fatalaties:	28
Umm Said, Qatar. April, 1977	Description:	Massive failure of refrigerated propane tank with subsequent ignition.
	Property Damage	US $127 million
	Fatalities:	7

Table 1

Ashland Oil Co. Pennsylvania, U.S.A.	Description:	A 4 million gallon diesel oil tank ruptured and overflowed its bund into a nearby river. A massive pollution clean up operation was required.
	Property damage:	One failed tank.
	Pollution damage:	US $250 million.
Norco Refinery, Louisiana, U.S.A.	Description:	Explosion and fire on a refinery catalytic cracker.
	Property damage:	US $290 million
	Fatalities:	7
Piper "A" Platform, North Sea, U.K.	Description:	Multiple explosions followed by loss of well control and fire.
	Property damage:	US $630 million
	Cost of well control & Redrill:	US $150 million
	Business Interruption:	US $250 million
	Fatalities:	167.

Note: All financial figures are estimates only.

Paper presented at the Oil, Gas & Petrochemical Seminar at New Delhi, January 1989.

Undoubtedly we will have learnt how to avoid many of the occurrences which afflicted us in the 1980s. However, the uncomfortable conclusion is that in the 1990s and beyond, we will have further major catastrophies around the world bearing witness to our infallibility to design and operate industrial plants with 100 per cent safety. Nonetheless we will continue to design and operate inherently hazardous industrial processes in the name of progress which is demanded by our society. The associated costs can be measured in financial, environmental and human terms and these are, by default, to varying extents considered an acceptable price to pay for progress. The "acceptable" limits are continually becoming more restricted by governmental regulations and international pressures, mainly in response to growing concerns about the earth's delicate environment and the value of human life.

However, what is not "acceptable" is to ignore, or be ignorant of, the lessons learnt by ourselves and by our unfortunate predecessors. In the words of Jessie Ducommun a senior director of a major international oil company, "it should not be necessary for each generation to rediscover principles of process safety which the generation before discovered. We must learn from the experience of others rather than learn the hard way. We must pass on to the next generation a record of what we have learnt. We have a moral obligation to our employers to try and protect assets and profitability. We have a moral obligation to our fellow men to try and protect each other and our environment. So how do we do it?

The first dimension of risk control which needs to be considered in developing an industrial operation is the relationship between the probability of a given incident occurring and the extent of the consequences should that incident occur. In many situations, the level of risk can be quantified in terms of the product of the probability and the consequence of an event. This derived parameter can then be used as a guideline to assess the "acceptability" of a given loss scenario. If a particular scenario is then assessed as being an unacceptable level of risk, then some change needs making in the situation.

These changes to reduce the risk frequently involve additional investment or operating costs, (although the risks can often be circumvented by ingenuity or use of new technology). An industrial operation is then faced with the problem of balancing its financial resources against the level of risk acceptability. Decisions to reduce investment costs and increase the level of risk, are often made ignorant of other increased costs; such as retroactive governmental requirement and insurance premiums, which may be a burden to the project at a later date.

Difficulties arise in trying to assess risk event probabilities and consequences, and this is where a good knowledg and data bank of worldwide loss incidents can assist in co relating theoretical predictions with actual statistical expe ience. For every major disaster which occurs, there are man smaller incidents which do not receive worldwide publicity Nontheless, these incidents are often painful for those directl concerned. They also contain many important lessons for th operators of industrial installations around the world. If suc an incident happens to a major multinational company th results of the incident inquiry may be passed around the va ious locations of that organisation and thereby receive som sort of global publicity. But in many cases, apart from thos immediately affected in the locality, good information o these losses is not generally well publicised.

There is however one particular central focus for this typ of information. This focus is provided by those who fre quently bear the cost of such incidents — namely the insur ance community. An insurance broker like Sedgwick, situate in the centre of the worldwide insurance market, is therefor in a privileged position to see much of the relevant infor mation concerning the misfortunes of those involved in th operation of hazardous industrial operations. The data pro vided by the oil, gas and petrochemical industries is parti cularly prominent because the values involved tend to b large. Using this type of loss incident data as a basis, an indu strial operation can be reviewed and assessed to try and iden tify and reduce the level of risk exposure. This process canno claim to totally eliminate risk; but when incorporated into a fully integrated risk management programme it can elim inate the exposure in financial terms by the transferance o the residual risk to insurers.

In assessing an industrial operation we can consider two distinct ways to control risk. The first involves the design and construction of the installation, to minimise the proba bility and extent of identified risks; or in short the "hard ware" features. The second way to control risk concerns the operation and management of the installation; or in short the 'software" features.

The hardware features are usually fixed during the construction phase, although to a certain extent they can be modified during the operational phase but usually at a higher cost. On the other hand, software features are associated with the operational phase; but similarly they can overlap the constructional phase in many areas.

The best time to review the hardware features of the risk is at the initial design phase. It can obviously be done at a later stage but this almost invariably involves additional cost, often of a totally prohibitive nature if the operation is going to remain economically viable. One major multinational industrial company carried out a review of project costs and

me up with the following broad conclusions on the costs making alterations to plant hardware at various stages of e project.

Retrofit/modification cost

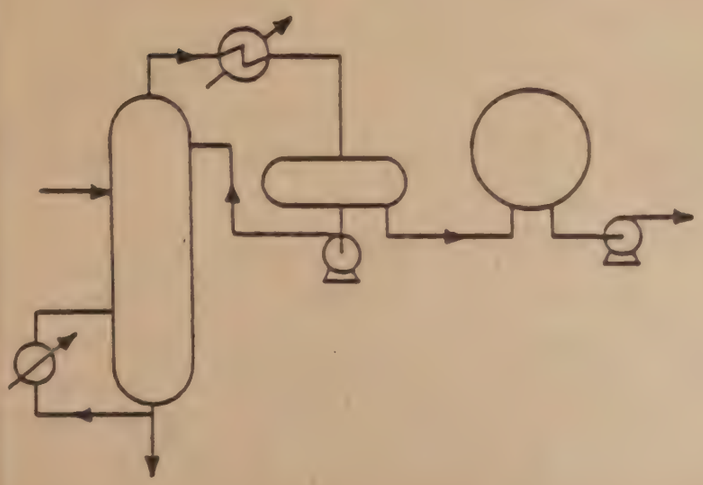
Stage	Cost
Conceptual design	1
Flowsheet design	10
Detailed design	100
After plant built	1000
Clean up the mess after the incident	10000

At Sedgwick we embody this message in a package of services called "Right from the Start". The key element of this hilosophy is to meet the client, the project contractor and rocess licensor (if applicable) and review the project based n Sedgwick worldwide experience. Risk reducing measures an then be incorporated at an early stage. This is usually ne most cost effective, both in terms of the construction cost nd the operational phase insurance cost.

The initial step in any review involves the identification f the risk exposures of the operation such as fire, confined xplosion, unconfined vapour cloud explosion, BLEVE, dust explosions, toxic release, flood and earthquake to name but few. Having identified the risk exposures, the appropriate ardware features can be evaluated for their suitability to control the extent and possibility of an incident.

One of the controllable hardware parameters which has a major influence on the magnitude of any fire/explosion incident is the inventory of flammable material. This has been tated simply by a leading loss control expert as "what you lon't have can't leak". The two following diagrams illustrate an example of how inventory reduction can be achieved.

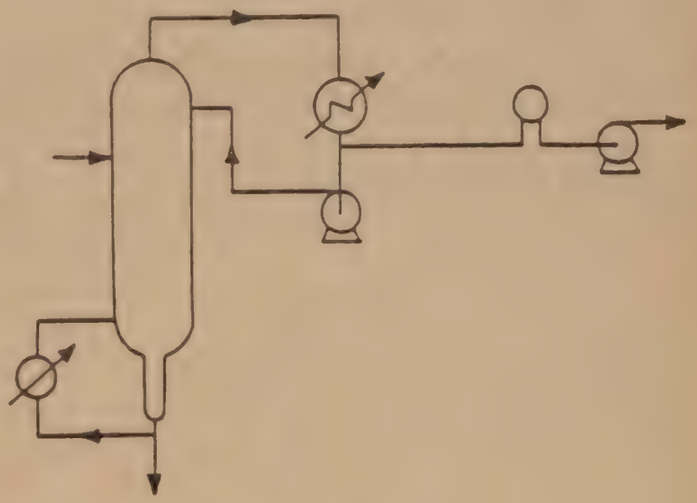
Figure 1
Original process design proposal



It is possible to reduce the

- column base inventory
- column tray inventory
- buffer storage inventory
- accumulator inventory

Figure 2
Revised process design proposal



Features

- Narrow section base-residence time 2 mins.
- Low inventory packing
- Refrigerant on tube side
- Accumulator removed
- Buffer storage replaced by small surge drum

If plant inventories can be rapidly isolatable in discrete sections of the plant by remotely operated isolation valves then the sources of fuel to a fire or potential fire can be reduced. Although seemingly common sensical the standards and practises used by the oil and petrochemical industry vary quite considerably. The recent Piper Alpha incident in the North Sea demonstrated quite dramatically the effect of inadequate inventory isolation capability.

Given that certain inventories of flammable materials are inevitable, engineering and construction standards need to be reviewed for suitability for the service intended, so as to minimise the possibility of a release of the inventory. However, if it is assumed that release can and does occur, and is ignited, an assessment needs to be made about the effect of the resulting thermal radiation and explosion overpressure. Various techniques are available for this and some have recently been developed into computerised models.

In limiting both the initial damage and the knock-on effects, the relative layout and spacing of process plant and equipment is often of paramount importance. This can be illustrated

in Figures 3 and 4 in an example concerning two ethylene plants. It can be quickly seen therefore that the loss potential can be significantly reduced by inventory control, appropriate engineering standards and good plant layout.

This type of approach should be extended to consider the suitability of other hardware aspects such as spill control, pressure relief systems, automatic fire detection systems and fire suppression systems, to mention but a few. Other risk exposures such as toxic release also need to be considered in a similar way.

A review of the software features can in theory be carried out at any time in the lifetime of an industrial operation with some considerable benefit. The software features can be considered as the way the people manage their hardware so as to minimise the possibility and extent of a loss incident.

Figure 3
Good Layout
5 psi UVCE overpressure circle following release and ignition of a vapour cloud of 6 tonne TNT equivalence

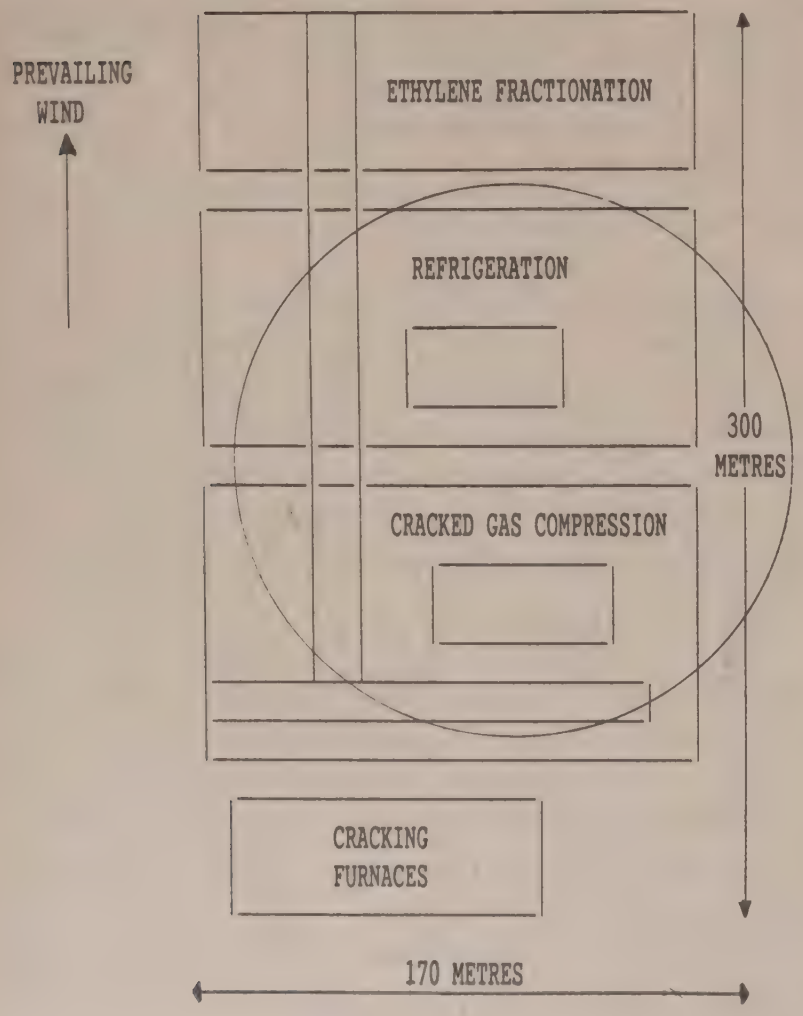
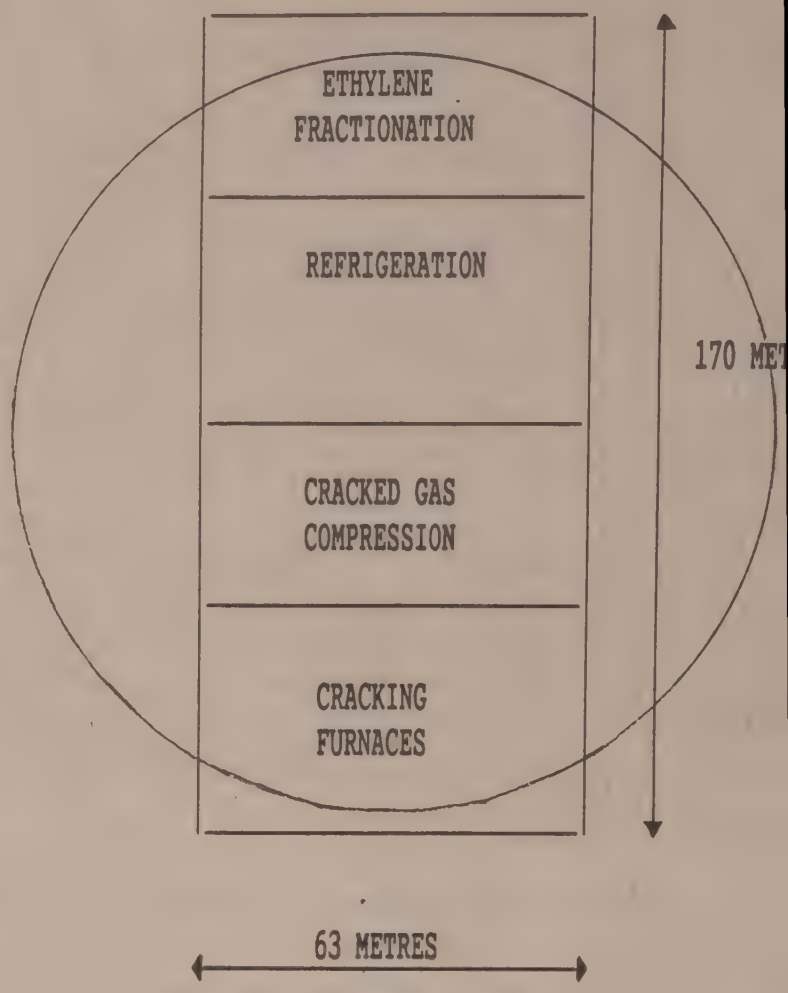


Figure 4
Poor Layout
5 psi UVCE overpressure circle following release an ignition of a vapour cloud of 6 tonne TNT equivalen
- Small process plot area
- No separation between blocks



A review of such features typically includes the effectiveness of the plant maintenance department including the organisation, experience, procedures and records; the inspection programme expertise and resources; the training and experience of plant operators; the emergency procedures and preparedness; and the plant safety philosophy and practical implementation.

For each of the various software features, Sedgwick can produce a ranking on a numerical scale, using, checklists for all of the various software features. This enables the management of an industrial operation to identify their strengths and weaknesses in risk control as compared to other organisations in the world. In making such an assessment of the software features, the inherent hazard and scale of the plant need to be taken into consideration.

As mentioned earlier, a risk can manifest itself not only n terms of damage to property, the environment and people, ut it can also seriously interrupt the profitability of an organi-ation. Any risk audit should therefore include a thorough eview of the business interruption exposures through the ntire operation, from the feedstock supplier to the customer remises. A relatively small fire in a process control com-uter room could have potentially crippling effects on the perability of a plant, leading to a major business interrup-ion. An incident such as Piper Alpha can also be seen to e having a long term effect on the revenue of the partners; except for one of the four partners who had a business inter-uption insurance policy to cover just such an occurrence. Many oil and petrochemical operations have historically devoted considerable attention to minimising the extent of property damage loss potential, but have not thoroughly eva-luated the interruption exposures and the effect on the eco-nomic viability of the business.

The basic purpose of a review of the hardware and soft-ware risk control aspects is to assist the management of an industrial operation to review the associated risks set against the worldwide experience of similar industrial operations. Any prudent risk manager will realise however, that the indu-strial disasters of the past suggest that it is not possible to totally eliminate risk. He will therefore buy insurance to cover the potential cost of the residual risk. In doing this the insur-ance market usually requires both qualitative and quantita-tive risk evaluation of the type discussed. When the insurance market is rocked by incidents of the type of Piper Alph, risk evaluation can assist in the favourable placement of insur-ance cover, especially for inherently high hazard industries such as the oil, gas and petrochemical.

The value of a risk evaluation to a risk manager is therefore threefold. He is able to implement improved physical and pro-cedural measures to control the risk; he is assisted in making his decision on what is the most appropriate insurance cover to buy; and thirdly he is assisted in the purchase of the insur-ance by having available a full profile of his risk exposure to present to the insurance market. It is for this reason that risk evaluations and design phase advice are part of an over-all package of international insurance broking and risk man-agement activity offered by the Sedgwick Group to oil, gas and petrochemical companies, often in conjunction with local insurance companies.

In conclusion it is important to recognise that in evalu-ating risk, both consequence and probability need to be con-sidered. The risk evaluation involves review of many different features which can be broadly categorised into hardware and software. A decision on the acceptability of the risk can then be made in terms of both the social and economic implica-tions. If these decisions are made with the assistance of the truly global experience of an international oil and petrochem-ical insurance broker, we may then have some hope of avoid-ing the mistakes of the past.

OTLIGHT ON INORGANIC CHEMICALS

Orthophosphoric Acid

(Wet Process Based on Nitric Acid)

B.A.V.K. SHARMA
Managing Director, Sharma Consultancy Services

troduction

The acidulation of rock phosphate with nitric acid yields mixture of calcium nitrate and phosphoric acid. Both the sultants exist in the single liquid phase. The main reaction represented by the following chemical equation:

$$Ca_5(PO_4)_2.CaF_2 + 2OHNO_3 \longrightarrow 10Ca(NO_3)_2 + 6H_3PO_4 + 7HF$$

The reaction is highly exothermic and results in the evolution of carbon dioxide, hydrofluoric acid, silicon tetrafluoride and nitric oxide gases. The separation of soluble calcium itrate from the phosphoric acid is not easy. Further nitric cid is more expensive than sulphuric acid, and also more itric acid than sulphuric acid is required to produce phosphoric acid. However the calcium nitrate has a fertiliser value y virtue of it's nitrogen content. Since the calcium nitrate hygroscopic by nature it is converted into ammonium itrate.

Calcium nitrate present in the dissolution liquor can be partially separated by crystallisation at low temperatures by dopting ODDA process. The crystals of calcium nitrate tetrahydrate obtained can be converted into ammonium nitrate by eacting with ammonia and carbon dioxide. Calcium carbonate is formed as a by-product.

Calcium nitrate can also be converted into gypsum and mmonium nitrate by reacting with ammonium sulphate hich is available as a by-product of caprolactam process. ypsum obtained can be converted back into ammonium sulhate for recycling adopting Merseburg Process using carbon ioxide and ammonia. In another method calcium nitrate is nverted into gypsum and potassium nitrate by reacting with otassium sulphate.

Liquid-liquid extraction can also be used to separate calium nitrate in a method similar to the use of solvent extraction for separating calcium chloride from phosphoric acid in e I.M.I. process. A combination process involving removal f a large part of calcium nitrate by crystallisation followed y solvent extraction with solvents like normal-butyl alcohol or methyl isobutyl ketone to separate the remaining calium nitrate is also proposed.

A combination process by St. Paul Ammonia Products of U.S.A. involves the cooling and crystallisation of calcium nitrate tetrahydrate from the dissolution liquor thereby removing 95% of calcium nitrate, precipitation and removal of residual calcium by sulphuric acid as calcium sulphate and distillation to remove nitric acid. The cost of making phosphoric acid by this method, based on credit for ammonium nitrate is considerably cheaper than the usual dihydrate process.

Manufacture

The basic process to manufacture phosphoric acid from nitric acid acidulation of rock phosphate by adopting St. Paul Ammonia Products process consists of the following three stages:

1. Digestion of rock phosphate with nitric acid to get calcium nitrate and phosphoric acid. Removal of fluorine compounds from the dissolution liquor.
2. Removal of calcium nitrate by crystallisation. Removal of residual calcium by sulphuric acid treatment.
3. Removal of nitric acid by distillation.

The block flow diagram of the process detailing the various stages of reaction is shown in next page.

Digestion

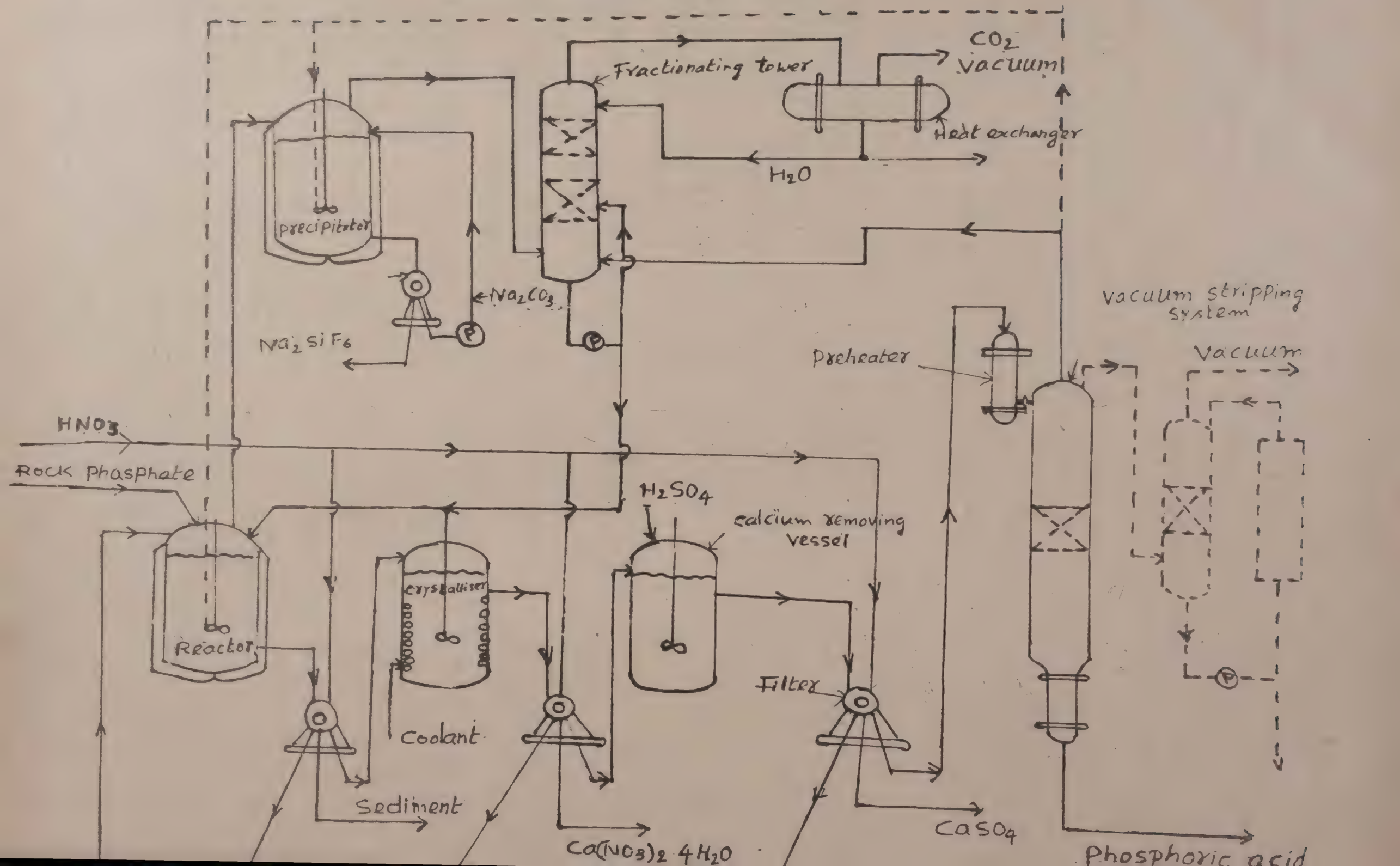
A florida rock phosphate which analysed as follows was used as the starting material.

Analysis of florida rock phosphate

Characteristics	Percent
P_2O_5	34.6
CaO	49.6
Fe_2O_3	0.9
Al_2O_3	1.0
F	3.9
SiO_2	4.4
Insolubles	4.5

The 2,205 parts of the above rock phosphate of particle size 98 per cent greater than 1.5 mm was acidulated with 5,962 parts of 52% nitric acid in a reactor. 464 parts of nitric acid of 66% concentration from the recovery cycle was also added. The amount of nitric acid added represents 25% excess of nitric acid over the stoichiometric requirement to convert all the calcium in the rock phosphate into calcium nitrate. The reaction was exothermic and foaming was controlled by

Manufacture of phosphoric acid using nitric acid



ition of defoamer. The nitric acid used was preheated to intain the temperature of the reaction mixture between -257°F. To facilitate the removal of fluorine impurities parts of silicic acid was added to the reactor. Under these ditions about 1,000 parts of nitric acid vapour was taken as a gaseous effluent carrying with it about 84% of the orine present in the rock in the form of hydrofluoric acid d silicon tetrafluoride, leaving about 0.18% fluorine in the ction mixture.

The effluent from the reactor taken to a precipitator was ated with 100% excess sodium ion, present as $NaNO_3$ ased on the reaction of sodium to form Na_2SiF_6), and elded about 120 parts of sodium hexafluorosilicate as a pre-pitate. About 67 parts of sodium carbonate was added to place the sodium ions which had been removed from the stem by the precipitation as per the following reactions.

$$2NaNO_3 + SiF_4 + 2HF \longrightarrow Na_2SiF_6 + 2HNO_3$$
$$Na_2CO_3 + 2HNO_3 \longrightarrow 2NaNO_3 + CO_2 + H_2O$$

462 parts of nitric acid of 66% concentration free from H_2O and CO_2 was returned to the reactor.

Removal of calcium

When the reaction mixture was allowed to stand for a short me, the sand and slime settled leaving a clear liquid on the op. The sand and slime were separated and washed with 238 parts of 58% nitric acid and this wash acid was returned n that form to the reactor together with 50 parts rinse water. The clarified mother liquor was then taken to the crystalliser nd subjected to chilling to form calcium nitrate tetrahydrate rystals. The chilling was done for two hours at 5°F. The crys-als which were sufficiently large in size were separated by iltration. The calcium nitrate tetrahydrate removed from the nother liquor accounts for 95% of the lime removed from ne original rock.

The remaining mother liquor amounting to about 2,392 arts with residual calcium nitrate which did not crystallise, vas then treated with 100 parts concentrated sulphuric acid n a calcium separation vessel. 122 parts of calcium sulphate were precipitated and separated; the precipitate being washed with 614 parts nitric acid and 30% rinse water, and the rinse water diluted nitric acid was then introduced into the acid-ulation reactor. The resulting mother liquor was a clear liquid containing approximately 1,000 parts orthophosphoric acid, 510 parts nitric acid and 11 parts fluorine probably in the form of HF, H_2SiF_6, and SiF_4.

Removal of nitrogen

To remove the nitric acid the above liquor was introduced nto a phosphoric acid stripper with the temperature of the ower at the top being 133°F and at the bottom 320°F at a pressure of 50 mm of Hg. The tower was filled with inert packaging and the vapour generated in the liquor was distilled off as 1,370 parts of a nitric acid — water vapour containing 44.8% nitric acid as HNO_3, leaving a residue of 1,084 parts of phosphoric acid containing 67.4%, P_2O_5 with only 0.04% HNO_3 and 0.1% F remaining.

The vapour was then contacted in the condenser with chilled nitric acid and the HNO_3 condensate returned to the acidulation reactor.

The nitrate can also be removed from the liquor by the use of a barium compound as a nitrate precipitating agent. The principle of barium nitrate precipitation is that the solubility of barium nitrate in water at 212°F is about 26%, this solubility is greatly lessened in phosphoric acid and further decreases with decreasing temperatures. The bulk of the barium nitrate precipitates from the liquor at a temperature ranging between 59-95°F leaving a barium nitrate concentration in the liquor of a maximum of possibly 3 to 5% based on a phosphoric acid liquor having about 40 parts by weight phosphoric acid for each 60 parts water. The barium nitrate concentration in the liquor is reduced to less than 1% (based on a 40 wt. % phosphoric acid liquor) by chilling the mother liquor to a temperature range of about 32°F to 14°F.

The barium nitrate obtained in the above process is reconverted into barium carbonate by reacting with ammonia and carbon dioxide as per the following reaction.

$$Ba(NO_3)_2 + (NH_4)_2CO_3 \longrightarrow BaCO_3 + 2NH_4NO_3$$

Pollution

The emission of fluorine compounds and nitrogen oxides during acidulation of rock phosphate and boiling of mother liquor creates pollution problems.

The by-product in this process is calcium carbonate and the quantity produced is less than that of gypsum produced in the dihydrate process. The calcium carbonate produced is about 2.5 tons against 5 tons of gypsum per every ton of P_2O_5 produced. This is due to the fact that the molecular weight of calcium carbonate is much lower than that of gypsum. Further the solubility of calcium carbonate is only one-thousandth of that of gypsum, the calcium carbonate is much easier to dispose of from an environmental point of view. Another advantage of calcium carbonate is that it is substantially used in the manufacture of prilled ammonium nitrate. Calcium carbonate can be used as agricultural lime to neutralise acidic soils, as feedstock for the cement industry, etc.

Conclusion

The economics of the wet process to manufacture phos-

phoric acid by nitric acid is independent of the sulphur prices.

The cost of production of phosphoric acid by nitric acid route is about 20% cheaper than dihydrate route.

Though nitric acid usage has many advantages the usage of sulphuric acid for the manufacture of phosphoric acid will continue to dominate. Even if the sulphur prices soar the sulphuric acid usage will continue because the sulphuric acid can be recovered for recycling from gypsum.

Usage of hydrochloric acid for the manufacture of phosphoric acid will be restricted to produce pure acid in smaller quantities because the availability of hydrochloric acid is limited.

Ultimately the choice of the process depends mo factors like the lower cost of production, easy availab raw materials, lower cost of plant and machinery, yields, lower pollution problems and availability of technology.

In places where sulphur is not available the usage o acid for the manufacture of phosphoric acid or nitr phate fertiliser assumes importance.

CORRIGENDUM

In the article published in 21st November 1989 the last but one para read '204 tons per hour' inst of 204 tons.

News about new projects

KEMIRA LINKS UP WITH UBE IN HYDROGEN PEROXIDE JV

Finland's state-owned chemicals group Kemira is forming a Japanese joint venture to produce hydrogen peroxide with Ube Industries.

The two companies have established a 50/50 joint venture which will build a 20,000 ton/year production facility in Ube, at the southern tip of Honsu Island. The joint venture is the first step in what could emerge as a series of collaborations between the two firms.

Estimated to be costing in the region of $50-60m, the new unit will supply Japanese demand by the end of 1991. Kemira will be licensing its own hydrogen peroxide technology to the joint venture, but a company spokesman said this is likely to be an isolated case. Feedstock will be supplied by other Ube plants at the site.

The Kemira technology is already being used in an operational unit at the Oulu plants in Finland. Moreover, the Finnish firm plans to use the same technology at its planned 20,000 ton/year hydrogen peroxide unit in the Netherlands, which should be in production in early 1991.

Much of the engineering work will be conducted by the two partners, although contractors will be brought in, they have yet to be selected.

Hydrogen peroxide is one of the fastest growing chemicals owing to its ability to be an environmentally friendlier paper and pulp bleach than chlorine.

A significant part of the new plant's output will be used in peroxide products in Ube's current range and in new applications to be developed with Kemira.

In addition to its use as an environmentally friendlier bleach than chlorine, because it breaks down into water and oxygen leaving no toxic byproducts, hydrogen peroxide can be used in industrial and municipal water treatment, for etching by the electronics industry and as a key oxygen donor in organic syntheses.

Although details have yet to be hammered out, the two firms are confident that they will be announcing other collaborations. "We are currently investigating the possibility of working together in the fine chemicals field," a company source said.

BP MOVES AHEAD WITH ACN PLANT

BP Chemicals new acetonitrile (ACN) purification unit is expected to start production during the second half of 1991.

Design and engineering work on the facility is nearing completion, although, as yet, the company has not contracted out the construction of the plant.

The unit will be located at the company's acrylonitrile plant at Green Lake, Texas, and will utilize BP's proprietary purification technology.

BP Chemicals currently operates two similar facilities at Grangemouth, Scotland, and Lima, Ohio, which have a combined capacity of 5 to 6,000 ton/-year.

The addition to the Green Lake facility, with a capacity of 7,300 ton/year, will more than double the company's production.

BP Chemicals' President John N. Turnbull said "Strong worldwide demand growth in recent years has led to a shortfall in acetonitrile. This investment is consistent with the company's philosophy of supporting growth by building to meet demand."

However, the company does not expect the US market to absorb the Green Lake plant's production and intends to export substantial quantities to Western Europe and the Far East.

ACN is a speciality solvent applied in advanced laboratory analysis and butadiene extraction.

STATOIL FORMS METHANOL JV

Statoil and Conoco Norway, as predicted, have begun negotiations over a joint venture to construct and operate a NKr2bn ($289m) methanol plant. The two companies are initially undertaking an extensive cooperative effort to refine the technical and commercial basis for the plant.

The study is expected to be completed in the spring of 1990. If the studies are considered viable, it is expected the plant will be built on the west coast of mid-Norway.

It is estimated the plants production will be about 840,000 ton/year of methanol. This production level would require deliveries of 750m cubic metres of gas/year, explained a Statoil spokesperson.

Gas will be supplied by Conoco's Heidrun oil-gas field, through a new regional pipeline from Haltenbanken to shore.

Statoil believes the venture has the capability to serve other European gas markets at a later date from the possible methanol plant location.

Meanwhile, sources say the move would secure the groups' positions as major methanol suppliers to the European market. Western Europe currently imports about half of its current methanol consumption.

PETROQUISA MULLS MeOH FACILITY

Brazilian state-owned Petroquisa studying the feasibility of establishir a 600,000 ton/year methanol unit on th Amazon river, in Amazonas state. Th facility would change Brazil's positio in the market from being an importer t a significant exporter.

Juca Bezerra, Petroquisa's vice pres ident, has pegged the investment a some $400m. This includes infrastruc ture and transportation costs. Schedule for completion in 1993, the plant wi be designed to use the abundant ga reserves at Urucu.

Brazil currently imports som 150,000 ton/year, but the proposed faci lity will result in exports, although th use of methanol as a feedstock for loca petrochemicals production is a mediun term goal for Petroquisa. Exports wil be targeted at the US and EC countries the world's largest consumers of meth anol.

Bezerrá says Petroquisa will seek both a private national and international partnership for the project. Petroquisa intends keeping a minority stake in the plant, to be based on technology provided by ICI or Lurgi.

Bezerra also cleared up Petroquisa's concerns over foreign participation in Rio de Janeiro's complex. He pointed out that there will be no objections coming from Petroquisa over international proposals for projects.

The company, Bezerra stressed, has no objections to linking up with multinationals either in raw materials or downstream production.

Petroquisa will consider proposals from all-comers. The final decision for downstream projects, however, is the responsibility of the industrial development secretariat.

Technological scene abroad

LUMMUS/MODAR LINK ON WASTE DISPOSAL PROCESS

US Engineering contractor Lummus Crest recently entered into a long-term agreement with the Houston-based Modar to commercialize a new flameless waste destruction technology that could challenge high temperature incineration.

The new supercritical water oxidation (SCWO) technology, pioneered by Modar, holds promise in treating a wide range of hazardous chemical wastes, including polychlorinated biphenyls, chlorinated dibenzo-p-dioxins, dinitro toluene and pesticides. The two companies are already working on the design and engineering of a 20,000 gallon/day plant and plan future units in the 10,000-100,000 gallon/day range. Operating costs are estimated at one tenth those of conventional incinerator systems.

The SCWO process makes use of the fact that water in its supercritical state (above 374°C and over 218 atm) is an excellent solvent for both organics and oxygen. By contrast, inorganic salts are only sparingly soluble.

Hydrocarbon wastes treated with oxygen in supercritical water rapidly breakdown to carbon dioxide and water. Heteroatoms, such as halogens, phosphorus and sulphur, if present, are converted to weak acids which in turn are neutralized by the addition of appropriate cations to form inorganic salts. These can be separated out and removed in the form of a concentrated brine.

In pilot plant testing, destruction efficiencies as high as 99.99999 per cent are reported, depending on the concentration of organics in the waste.

Announcing the agreement, Lummus Crest President, Stephen Solomon said the SCWO process was "an alternative solution to many current hazardous waste destruction processes which are under environmental attack or do not meet regulatory standards."

Because the SCWO environment is flameless, the process will not require a hazardous waste incineration permit under the US Resource Conservation and Recovery Act.

PVC PRODUCERS PLAN MIXED PLASTICS RECYCLING GROUP

Seven top European PVC manufacturers are finalizing the legal framework for a consortium that will promote "mixed" plastics recycling -- the first large-scale initiative of its type.

The companies, which have not all been named, are set to announce the venture in the next five months. The PVC producers are leading the initiative under the auspices of the European Council of Vinyl Manufacturers (ECVM), and have invited other plastics companies to join them.

The joint venture format is still to be decided, but the ECVM suggests a European Economic Interest Group (EEIG) might be most likely. This would have the advantage of not infringing EC competition laws. The body will separate from the ECVM when established.

The aim is to develop a suitable technology for recycling mixed plastics, initially to be collected from municipal waste streams. In addition, the search for markets for the recycled products will continue. So far, the venture has taken an option on technology for a concrete substitute marketed by Wormset Kunstoffe Recycling (WKR) of Worms, West Germany.

According to the ECVM, the WKR process can mould up to 250kg in a single piece, and the company has produced park benches, anti-noise barriers for motorways and street sign supports in a small-scale operation. The other contenders produced a more limited range from recycled mixed plastics.

A spokesman from European Vinyls Corporation, one of the participating companies, said, "the manufacturers want to demonstrate mixed recycling as viable." Plastics recycling is becoming more widely available for individual products, such as PET and PVC, but few uses for recycled plastics which have not been pre-sorted have been identified.

The initiative seems likely to pre-empt legislation, proposed in most West European countries, that will force local governments to reduce their landfill use. Removing plastics from the waste stream would reduce this considerably.

CYANAMID OPENS HERBICIDE PLANT

Cyanamid's international agricultural division has opened a new 20,000 ton/-year formulation facility for its crop protection chemicals in Gravelines, northern France.

The FF150m ($23.6m) plant will use proprietary technology to manufacture water-based suspension concentrate forms of a range of herbicide products.

It will be the only plant in the world producing the liquid form of Stomp, the company's herbicide to control grasses and broadleaf weeds in major crops.

Other products include Assert and avenge herbicides, for pre- and post emergence control, respectively, of wild oats in wheat and barley, as well as various combination products.

Speaking at the inauguration ceremony, Cyanamid's Chairman and ceo George Sella said the new plant would enable the company to meet its projected European market needs for liquid formulations into the 21st century.

IDEMITSU DEVELOPS C5 RESIN PRODUCTS

Japan's Idemitsu Petrochemical is understood to be close to commercializing high value added products based on its C5 petroleum-resin technology.

The company has developed technology to produce a range of transparent grade hydrogenated petroleum resins aimed at the expanding market for hot-melt adhesives, such as those used in disposable diapers.

The company is expected to begin commercial production from a 5,000 ton/year plant at Tokuyama and establish proprietory brands over the next 12 months.

The company is also understood to be commercializing acrylic acid, acrylic esters and bisphenol A, and building up its operations for oligomer chemicals.

GE LICENSES ENIMONT POLYCARB KNOW-HOW

Enichem Synthesis, the fine chemicals arm of Italy's recently formed Enimont group, has signed an agreement to license its proprietary technologies for dimethyl and diphenylcarbonate production to GE Plastics, the world leader in polycarbonate production.

Enimont's dimethylcarbonate process is based on direct oxidative carbonylation of methanol, claimed to represent an important breakthrough.

Enimont has operated the process at its Ravenna site since 1984, and has recently increased capacity to 8,800 ton/year.

The diphenylcarbonate process, based on transesterification of dimethylcarbonate and phenol, is also used at Ravenna.

The 4,000 ton/year unit is fully inte grated with the dimethylcarbonate plan and can produce both technical and po lymerization grades.

The licence agreement gives GE Plas tics the right to adapt Enimont's tech nologies to the production o polycarbonate resin.

GE Plastics manufactures polycarbo nates at three locations: Burkville, Ala bama; Mount Vernon, Indiana; an Bergen op Zoom, the Netherlands. declined to comment on how it woul make use of the licensed technology

DU PONT STEPS UP SUPERCON DUCTOR R & D

Du Pont is stepping up superconduc tivity research by teaming up with the US Department of Energy's Lo Alamos National Laboratory and the electronics manufacturer Hewlett Packard.

Under a three-year $11m agreement the three organizations will focus on the development of thin-film high temper ature superconductors for electronic components.

They will pool resources in basic and applied research, materials production and processing and electronics applications.

The agreement is believed to be one of the largest collaborative research and development programmes concluded between a US government laboratory and industry.

Separately, DuPont has also established cooperative superconductivity research agreements with the other two Department of Energy pilot centres, Argonne National Laboratory in Illinois and Oak Ridge National Laboratory in Tennessee.

Environment

DOW CUTS CFCs FROM PU FOAMS

The race to eliminate CFCs from the manufacture of polyurethane foams continues unabated. The latest announcement comes from Dow Europe for a CFC-free furniture foam manufacturing method, developed in conjunction with UK foam manufacturer Hyman. The process employs a proprietary additive which permits higher water levels in the reaction between the component polyol and isocyanate. The water reacts with the isocyanate, releasing carbon dioxide.

This in turn is used to blow the foam, eliminating the need for CFCs. But the process does require changes to the polyol/isocyanate formulation, believed to be on the polyol side. Product quality and performance characteristics are said to remain unchanged. Stockport-based Hyman has been collaborating with Dow for four months in developing the new chemical formulations for the manufacture of its new *Hygard* combustion-modified high resilient furniture foam.

A spokesman for Hyman said that the company had been using the new system in the manufacture of its lighter and softer grades of foam since June last. It has now totally eliminated CFCs from its foam-blowing operations. Union Carbide detailed its new process for eliminating CFCs from the manufacture of moulded polyurethane foams used for car seats recently.

AUSTRALIANS WIN GRANT FOR PCB CLEAN-UP PROCESS

Efforts to find alternatives to high temperature incineration for the destruction of chlorinated hydrocarbon wastes, including polychlorinated biphenyls (PCBs), continue apace. Scientists at the University of Sydney, Australia, have won a grant of Aus$ 73,000 ($58,000) from the state of New South Wales to further their research into a promising low temperature oxidation process.

The research team, led by Professor James Beattie, is developing a novel process, called Sydox, using bleach as an oxidizing agent. It leaves inorganic salts as products and holds potential to treat a range of chlorinated hydrocarbons; insecticides such as DDT; PCBs; and hexachlorinated biphenyls (HCBs). Beattie believes the process can be scaled up to tackle the growing problem of HCBs in Australia, with a cost advantage over incineration.

Australia has no domestic incineration capacity, so either stockpiles its problem chemicals or exports them for destruction. ICI Australia's Botany Bay plant alone is reported to have 8,000 ton of HCB in store. Meanwhile, Degussa is claiming commercial success in using sodium to treat oils contaminated with PCBs and other chlorinated compounds. The method has been used to reprocess up to 8 ton/day of industrial oils at Societe des Huiles Lemahieu, near Lille, France, since October 1988.

PCB levels of 500ppm are being reduced to 2ppm, and all but 2-3 per cent of the oil is suitable for reuse. The residue is a mixture of sodium chloride and non-toxic polymers. A second similar-sized unit has recently been started up in Lyon, France, specifically to treat transformer oils. Further units are planned next year in the UK and West Germany.

Degussa claims sodium has wider application in treating industrial solvents with up to 5 per cent chloride contamination. "The process is technically possible for chloride contents up to 50 per cent, but becomes less economical because of the large amounts of sodium required", said a company spokesman. For low chloride levels, around 500ppm, costs are estimated at around DM200/ton ($108) of oil.

Biotechnology

SYNERGEN BEGINS ULCER DRUG TRIALS

US biotech concern Synergen has begun evaluation of its basic fibroblast growth factor in patients with topical ulcers. The Phase II trials, to be conducted at six medical centres in the US, are designed to evaluate the efficacy of the human protein in the treatment of diabetic ulcers and venous stasis ulcers. Basic fibroblast growth factor is a potent stimulator of angiogenesis (the formation of new blood vessels). Synergen also claims it induces the multiplication of certain cell types, including fibroblasts and vascular endothelial cells, which are required for tissue repair.

The protein is being produced using recombinant DNA techniques in pilot plant facilities at Boulder, Colorado. Earlier last year, Synergen licensed European marketing rights for topical applications to Ciba-Geigy's Zyma subsidiary. Zyma will be responsible for conducting trials for product registration in Europe.

Synergen has also announced that its anti-inflammatory drug IL-1i has demonstrated therapeutic activity in animal models of rheumatoid arthritis. If the results are confirmed in anticipated clinical trials, Synergen believes the IL-1i protein could form the basis for the next generation of anti-inflammatory drugs. The IL-1i protein acts as a receptor antagonist for IL-1i, preventing intercellular signal molecules from initiating inflammatory cellular processes.

SKB TO EXPAND VACCINES PLANT

Belgium's SmithKline Biologicals, a subsidiary of SmithKline Beecham, is extensively expanding its vaccine manufacturing facilities in Rixensart, south of Brussels. But state aid from the Belgian Government of BF248.8m ($6.38m), believed to be around 4 per cent of the total, is being opposed by the EC Commission.

The expansion plans are twofold. They include new manufacturing, warehousing and distribution facilities to meet a growing demand for Engerix-B, the company's genetically engineered vaccine for hepatitis B. The second part of the investment will be for the production of viral vaccines derived from mammalian cells.

Meanwhile, the Commission has opened a procedure against the finance proposal, saying that it is "outside the usual rules for state aid" and "threatens to distort competition." Under the EC framework, state aid can usually only be made available for full scale manufacturing facilities in designated development areas. The Belgian Government and other interested parties must submit views to the Commission shortly.

AL PLANS DRUGS UNIT

Norway's Apothekernes Laboratorium (AL) is to build a Nkr250m. ($36m) facility in Lier, south Oslo, which it claims will be the world's most automated pharmaceutical plant.

The plant is expected on-stream in mid-1991 and will replace some of the company's current production.

AL manufactures a range of about 80 generic pharmaceuticals, both ethical and otc. The prescription range includes antibiotics and tranquilizers. Otc products include vitamin and indigestion tablets.

A spokesman said the new plant will double productivity with automated manufacture, inventory and packaging of raw materials and finished products. The company aims to export 40 per cent of production.

MAJORS RACE TO DEVELOP TRANSPLANT BLOCKBUSTER

Drug companies are competing to the first to produce a family of drugs prevent organ transplant rejectio Researchers at Fisons, Fujisawa ar Merck, Sharp & Dohme are developin an immunosuppressant based on FK 506. Success could lead to a share of th burgeoning market forecast to be wort $2bn by 1995.

Attention has been drawn to th development of FK-506, following th publication of some preliminar research results. Trials of FK-506 as a anti-rejection agent, at the University o Pittsburgh, produced results describe as "astonishing" in patients who ha undergone major transplant surgery.

Japan's Fujisawa Pharmaceutical Co discovered the drug in 1984, while engaged in a three-year-old collaborative agreement with the UK company Fisons. Both companies have continued research on the drug, but Fisons has focused on analogues to find preparations with fewer side-effects and toxicity problems.

FK-506 is a naturally occurring macrolide antibiotic. It shares many of the properties of cyclosporin A (CsA), the only approved immunosuppressant marketed by Sandoz as Sandimmun. Researchers claim FK-506 has a potency 100 times greater than CsA, in the suppression of lymphocyte reactivity and the generation of cytotoxic T cells in animals.

It is projected that FK-506 will be used to treat auto-immune diseases such as rheumatoid arthritis, psoriasis, uveitis, Crohn's disease and multiple sclerosis, in addition to use in the prevention of organ transplant rejection. Trial results in Pittsburgh have been encouraging. Of the 60 patients taking the drug following a kidney, liver, heart or pancreas transplant, a rejection rate

less than 2 per cent was reported. his compares with up to 50 per cent r patients using CsA. It is claimed that K-506 works faster and has a milder de-effect profile than CsA.

However this claim would appear to e refuted by Sandoz, which has opped work on FK-506. Sandimmun, e company's top product, earning 450m/year, continues to be developed nd Sandoz believes its product has a niquely high degree of efficacy and ood tolerability in long-term preven- on of transplant rejection.

Scientists at Merck, Sharp & Dohme re seeking to understand the funda- ental biochemical action of both CsA nd FK-506. Dr. John Siekierka xplained that Merck is attempting to nd receptors and discover the binding te of CsA and FK-506, in order to find ne point of inhibition. This would nable the company to develop other ossible reagents, he believes.

A Fisons spokesman said the com- any has patented 32 analogues of FK- 06 and identified lead products to ursue. He believed Fisons was nearing ne end of the research period and clin- al work would start in 1990. He added nat, whilst the company remained uietly optimistic about FK-506, it is till a long way from the market.

Although the partnership with Fujis- wa has been dissolved, the two com- anies continue to cooperate in the levelopment of analogues. Fujisawa, vith the only fermenter producing FK- 06, has supplied Fisons with product or research purposes.

COURT HALTS HOECHST INSULIN PLANT

The superior administrative court in he West German state of Hesse has ordered Hoechst to stop work immed- ately on its DM70m ($37.8m) test omplex for genetically engineered uman insulin at Frankfurt. This means that the company will have to stop operating the fermentation stage (Fermtec) and halt construction on the chemical purification stage (Chemtec) until a final decision on objections to the complex has been made by the courts. According to Hoechst, a decision is not expected "in the foreseeable future.".

The latest ruling was made in response to an objection to the state's reinstatement of permits for the complex in July 1988 but, a basis for the court's decision had not been made public. The planned three-stage human insulin complex has been the subject of dispute between Hoechst and West German opponents of genetic engineering for nearly five years. Objections by local residents, environmentalists and politicians have intermittently blocked construction and operation since 1985.

Permits to build and operate the first two stages (the final stage is test-scale production) were granted in June 1985 and October 1987 respectively, but suspended in November 1987 after new objections were filed. Particularly in view of the latest developments Hoechst continues to be "greatly concerned" about the possibility for industry exploitation of genetic engineering technology in West Germany, a spokesman said. The company will continue to supply patients with its modified pig insulin which is identical to human insulin.

IMMUNEX CLONES IL-4 RECEPTOR

Scientists at Seattle-based Immunex have announced the successful cloning, and isolation in soluble form, of the mouse Interleukin-4 (IL-4) receptor molecule. The discovery could hold promise in preventing organ rejection following transplant surgery and in treating allergies and asthma.

The IL-4 cytokine promotes the production of certain antibodies, including IgE which is involved in allergic and asthmatic reactions. IL-4 is also known to activate T-cells to kill tumour cells or infected or transplanted tissue.

Like other cytokines, IL-4 works by binding to matching receptors on the surface of immune cells. When bound, the receptor triggers a signal from the cytokine to the cell, promoting the immune response. A free-floating, or soluble, receptor can act as a decoy. It retains the ability to bind to the IL-4, but is unable to trigger the immune response, thereby suppressing the specific immune reaction.

Soluble IL-4 receptors are widely held to be produced naturally in humans as the body's way of turning off an immune response. The Immunex scientists now suggest the cloned receptors might be of use in eliminating a variety of disease-causing auto-immune responses.

"One of the problems with current treatment for counteracting auto-immune or inflammatory diseases is that immunosuppressive drugs are too general and can over suppress or damage a patient's immune system," says Immunex chairman and ceo Stephen Duzan.

European marketing rights to the receptor have been granted to Hoechst subsidiary Behringwerke. In exchange, Immunex has gained the US co-marketing rights to GM-CSF, IL-3 and other CSF products.

GENETICS INSTITUTE GAINS US PATENTS

Genetics Institute has obtained two US patents for new biotechnological products: human blood cell growth factor, Interleukin-3; and BMP-1, an agent which can induce the formation of new cartilage.

The Cambridge, Massachusetts-based company has patented the materials and methods for Interleukin-3 (IL-3) using

recombinant DNA (rDNA) technology, and has licensed rights to Sandoz, which is conducting preclinical studies.

The US company claims IL-3 acts earlier in the pathway of blood cell development than other growth factors and may be used in combination with similar products such as GM-CSF. It is likely to prove valuable as a treatment for blood cell deficiencies associated with cancer treatment, bone marrow transplantation and other blood cell disorders.

The second patent covers BMP-1 type proteins and methods for treating bone and cartilage defects. Bone morpho-genetic proteins (BMPs) act by recruiting bone forming cells, initially producing cartilage which by further development and mineralization forms bone. BMP may be useful in fracture healing and treating bone loss following periodontal disease and certain cancers.

PGS UNVEILS SEEDS BREAKTHROUGH

Plant Genetic Systems (PGS) of Ghent, Belgium, recently announced what it claims is a breakthrough in hybrid seed production. The discovery could lead to the creation of new and more efficient hybrids. Working in collaboration with Profesor Robert Goldberg of the University of California at Los Angeles, the Belgium agrobiotechnology company has constructed and expressed a gene that prevents pollen development in crop plants, specifically rapeseed oil. The result is a male sterile plant, an essential component in the creation of hybrid seed. Traditional methods for instilling male sterility in plants can be costly and inefficient, claims PGS.

The scientists say they have succeeded in isolating a promoter that allows the expression of a gene exclusively during the development of a plant's anthers (the male reproductive organs).

According to Jan Leemans, research director of PGS, this anther-specific promoter has been used to express in the plant a gene conferring male sterility. Through the promoter, a protein encoded by the gene is expressed only during the critical few days when pollen would normally develop in the plant, suppressing its production. The protein then disappears after rendering the plant male sterile, allowing it to continue normal development.

Apart from the economic significance to rapeseed oil, which accounts for some 2m hectares of plantation in Europe, PGS claims the introduction of a gene in only a small part of a plant for only a few days is "unique in genetic engi ering."

Further, the company claims the n system is "universal", except for cere Work is continuing on a wide range crops from vegetables, such as bruss sprouts, to soya bean and cotton.

PGS has filed worldwide patents a plans to market the new technology major seed companies. It is in "seric discussion" with a number of comp nies on possible licensing and joint ve ture arrangements which it expects to up on a case-by-case basis. The ne hybrids could be on the market by 199

Commenting on the developme Michel Renard, research director France's Institut National de Recherche Agronomique, said it n only represented a major technologic breakthrough, but "gives breeders gre flexibility to create new hybrid vari ties."

In the UK, a spokesman for ICI See described the development as elega science. "We shall be very interested see how it compares, in practical term with several other systems whic already exist for the creation hybrids," he said. He added that ICI ha its own system for the hybridization rapeseed oil which it is already marke ing in Canada and the US.

News from Japan

EW ASSOCIATION TO PUSH LOBAL FINE-CERAMICS CO-PERATION: MITI

The Ministry of International Trade nd Industry (MITI) will set up "Inter-ational Fine-ceramics Co-operation nd Control Association" (tentative ame) next spring in hopes of bringing bout greater world-wide collaboration n the fine-ceramics industry. The rganization -- which will consist of ndustrial, government and academic nembers, with the latter coming from niversities and national research insti-utions -- will establish contact points n countries around the world and foster exchanges of research findings, infor-nation and personnel. While exchanges f business, university and R & D staff were conducted individually in the past, hese activities will be completely inte-grated with the inauguration of the new rganization.

Management of the association is likely to be entrusted to Japan Fine Ceramics Center (JFCC), an organiza-tion that appraises and conducts tests on fine-ceramic materials. Since JFCC functions will be enhanced to enable it to act as an overseas information outlet, MITI is also reportedly considering plans to cultivate the organization to be "International New-materials Center" in future. The importance of fine ceram-ics in high-temperature, high-strength structural materials, electronic compo-nents, and aerospace applications is fueling expectations for further growth. As a result, lively development compe-tition has spread out from the United States and Europe to Japan and other countries.

The size of the Japanese fine-ceramics market in 1988 reportedly topped ¥1 trillion. Sources say that in production-value terms, this accounted for 70% of the global market. In view of recent trade friction in high-tech fields, MITI has been studying for some time ways to bolster international co-operation in the fine-ceramics industry. Successful mediation by means of a consensus between the industry and its related organizations thus crystallized, plans to form the new association.

The association -- scheduled for initiation next spring -- will enlist the participation of JFCA, JFCC, Japan Ceramics Association, domestic universities, and national research institutions in its establishment. In addition to fostering exchanges of research findings, data and staff, the organization will hold discussions and seminars designed to contribute to world-wide fine-ceramics industrial development. Sources cite the possibility of the association joining in fine-ceramic automotive gas-turbine research currently being conducted by the U.S., West Germany and Sweden.

NISSAN MOTOR EMPLOYS NEW EQUIPMENT FOR TESTING ENGINEERING PLASTICS

Nissan Motor Co. -- one of Japan's leading car makers -- has decided to employ next spring fully automatic equipment for assessing the properties of engineering plastics to be used in automobiles. The equipment was developed by Mitsubishi Kasei Corporation. It is capable of completely automatically feeding samples to itself, measuring their thickness, assessing their strength (tensile strength, bending strength and shock resistance, etc.), removing them therefrom, and processing the data thereby obtained using a personal computer and printing it out.

Conventional testing equipment calls for employment of a worker who feeds and replaces samples and processes data. What is worse, it is not able to provide precise data. Engineering plastics will not be used in Nissan Motor's cars unless they pass the tests conducted using the equipment. Nissan Motor's decision will considerably influence other car makers with regard to their assessment of engineering plastics.

Mitsubishi Kasei expects the equipment to be employed by many more car manufacturers and plastic makers and plans to aggressively market it on the Japanese, and in addition, U.S. markets. It is possible to incorporate the equipment into existing testing systems and control several units of the equipment using a single personal computer.

"SIRIUS" NEW-TYPE HERBICIDE & VERSIONS APPEAR ON MART

Nissan Chemical Industries, Ltd. has begun marketing a series of its "Sirius" 1-shot herbicides for paddy fields. Sirius is Nissan's brand name for its new-type 1-shot herbicide exhibiting a powerful weed-killing effect with a very small amount of application. The items being marketed this time are "Sirius G" and its seven complex herbicides. The company intends to develop them to the point where their combined annual sales can reach ¥10 billion within five years.

It is believed the emergence of powerful Sirius will stir the 1-shot herbicide market in Japan where makers are already engaged in severe competition among themselves. Under a 5-year plan that started in 1989, Nissan Chemical is strengthening its involvement in the drug and agrochemical field along with the elaborate function-material field and the specialty-chemical one. Sirius is followed by "Targa" herbicide marketed for farm use in overseas countries.

The effective ingredient of Sirius is pyrazosulfuron-ethyl — a sulfonylurea compound with a pyrazol ring — developed in 1982 by Nissan Chemical. With its effective content of as little as 0.07%, Sirius can display a prominent effect against most weeds in a paddy field. It is also quite safe, has a longer application period and a longer residual effect. As Sirius itself is not effective for killing barnyard grass as are other sulfonylurea compounds, the company has marketed the series of versions

containing Sirius and other-type effective ingredients.

WESTERN FIRMS, SOVIETS AGREE ON BIG PETROCHEMICAL PROJECT IN SIBERIA

A consortium of private companies in Japan, the United States and Europe has agreed to form a joint venture in the Soviet Union to build and operate from 1993 a $2.2-billion petrochemical complex in western Siberia. The agreement concerned was reached in late November last between the consortium, led by Combustion Engineering Inc. (U.S.) —and the Soviet Ministry of Chemical and Oil Refining Industries.

The joint-venture company (capital: $660 million) -- to be called Western Siberian Petrochemical Co. (WESPEC) -- will be located in Moscow and owned 85% by the Soviet side and 15% by the Western consortium. The said project calls for construction of production facilities in Tobolsk with an annual production capacity of 450,000 tons for polypropylene and 100,000 tons for styrene. Construction will be inaugurated shortly with completion scheduled for 1993.

The consortium includes Neste Oye -- a major Finnish oil refiner -- Mitsubishi Corporation and Mitsui & Co. --two major Japanese general trading firms --and a syndicate of banks led by Morgan Grenfell & Co., a British merchant bank. The two Japanese companies will undertake procurement of machinery and equipment, while Neste will be in charge of exports of the joint venture's products. The Soviet and Western sides signed an agreement on feasibility studies for the international project in December 1988. They originally worked out a $10 billion project aimed at building roughly 40 manufacturing plants for methanol, benzene, styrene monomer, polypropylene, synthetic rubber and methyl tert-butyl ether, etc. The project has, however, now been scaled down to the $2.2 billion one.

Western companies are scheduled to establish a joint-investment firm in Vienna, Austria, in which the two Japanese firms will invest two million dollars each.

PETROCHEM INDUSTRY TACKLES ENVIRONMENTAL PROBLEMS

Japan Petrochemical Industry Association has established a Forum for Environmental Problems, which is comprised of the association's two committees covering the environment/-plant location and technology, respectively.

As a first step, the new organization invited MITI officials in order to exchange related information with them. It is scheduled to collect accurate information from other industrial circles and the government and work out antipollution measures for the sake of the petrochemical industry.

The association formed the forum by combining the two committees since environmental problems are widely related to global warming, acid rain, depletion of the ozone layer, pollution in developing countries and transfer of harmful wastes over borders and exert far-reaching influence on societies and economies.

ARAKAWA CHEMICAL COMPLETES NEW FACTORY WITH 12,000 TON/YEAR CAPACITY

Arakawa Chemical Industries, Ltd., the top Japanese maker of naval store products, has recently completed 1st phase construction of its Onahama factory in Fukushima Prefecture. The new facilities will enable the company to produce 12,000 tons per year of printing inks, adhesives and various resins for paints. Total construction costs were ¥5 billion.

Arakawa had been constructing the factory since December 1988 on a 72,100 m² plot of land it purchased the coastal industrial site of Onahar in order to meet growing demand for products and establish a base to supp users in the Kanto and Tohoku distric

The five-storey facility, which has total floor space of 6,500 m² and s production lines, offers the followi advantages: (1) computer-aided mul purpose batch-processing, enablir small-lot and wide-variety productio (2) substantial labor savings; (3) th most advanced industrial water trea ment system; (4) an on-line system co necting it with the head office and oth factories; and (5) an interior arrange ment emphasizing the flow of materi and products. An initial staff of 30 wi operate the factory.

In the near future, Arakawa will als begin 2nd-phase construction at th Onahama site for paper-making chem icals and other products.

ULTRAPURE WATER MAY SEE GROWING MARKET AS SUBSTITUTE FOR CFCs

Kurita Water Industries Ltd. is now pushing on with a market survey concerning equipment producing ultrapure water as a substitute for chlorofluorohydrocarbons (CFCs) for cleansing industrial parts. Substitutes for CFCs are being earnestly sought throughout the world because of the destructive effects of the latter on the ozone layer.

In Japan, CFCs are being replaced, to some extent, by isopropyl alcohol (IPA) and ultrapure water for cleansing semiconductor chips, but effective alternatives are not available as yet for cleaning magnetic disks, printed circuit boards and glass lenses, etc.

Technological advances, however, have made it feasible to apply ultrapure water (UW) to cleaning of the products for which UW has not so far been used in view of problems with regard to drying and application to oily products.

New Developments from Japan

HOCK-RESISTANT PREPREG SABLE AS MATERIAL FOR IRCRAFT

Toho Rayon Company has developed ock-resistant prepreg (trade name: -C332) -- carbon fiber-reinforced plas- (CFPR) – for use in primary struc- ral material for airplanes. The new oduct has already been supplied to mestic aircraft makers in sample rm. The prepreg is produced by pregnating "Besfight IM600X" high- ength, middle-elasticity carbon fiber th bismaleimide resin (Toho # 332 sin). It has a high degree of thermal sistance, high-temperature/high- isture properties and after-impact mpression properties (23°C, dry, kg/cm²).

The company claims that the physi- l properties of the new product meet eing (U.S.) set standards for struc- al materials. Fuji Heavy Industries d Kawasaki Heavy Industries apan's leading aircraft makers -- are sessing the adaptability of the new oduct to I-shaped beams. In addition, y are comparing the product with ock-resistant prepreg which Narmco .S.) developed for the European ghter Aircraft Program.

The product is cured at a temperature 180°C and calls for no additional ring process. It has long shelf life °C, dry) and after-impact compres- n strength, 34kg/mm² (23°C, dry) d 29.1kg/mm²(121°C, wet). The in properties of the above-mentioned in are: specific gravity, 1.25; glass- nsition temperature, 225°C; bending ength 15kg/mm²; crossbreaking perties, 350kg/mm² and fracture ghness, 1.3 megapascal.

NG GLASS FIBER REINFOR- D RESIN BARED: MITSUI ATSU

Mitsui Toatsu Chemicals, Inc. has developed long glass fiber-reinforced thermoplastic material for injection molding, dubbed "long-fiber pellets." The company, together with makers of molding equipment, has begun to exploit application fields for the new product.

The new material is produced using the unidirectional prepreg technology usually applied to production of thermoplastic composites. It has a high degree of compatibility between long glass fiber and base resin.

Conventional-type long glass fiber-reinforced molding material is produced by means of the "electric wire-covering method," in which the long glass fiber employed is covered with synthetic resin and cut into given lengths.

The advantages of the new product are:

1. It is capable of containing more than 50% (in terms of weight) of glass fiber, thereby attaining a high level of rigidity.
2. The long glass fiber contained therein helps the material itself display shock resistance more than double that of short glass fiber-reinforced material and excellent fatigue/creep properties.
3. The long glass fiber is dispersed more uniformly than is the case with conventional products, and
4. The long glass fiber and synthetic resin concerned have good surface-adhesiveness.

The company claims it is possible to raise the content ratio of long glass fiber to 70~80%. The new product is capable of markedly reducing production cost for moldings when it is employed as master batch.

The company envisions adding long glass fiber to crystalline resins (nylon and polypropylene, etc.) using the abovementioned process. Long glass fiber-reinforced polypropylene (reinforcement content: 30%) has the following physical properties: tensile strength, 1,300 kg/cm²; Izod value, 25kg/cm/cm. The company plans to apply the said technology to production of carbon fiber-reinforced material some time in the future.

FLUOROCARBON-FIBER SHEET DEVELOPED AS FILTERS, ELECTRONICS MATERIAL

Showa Industry Co. and Tomoegawa Paper Co. have jointly developed porous fluorocarbon-fiber sheet produced from polytetrafluoroethylene (PTFE). The new sheet consisting of fluorocarbon fibers having uniform diameter is 0.05 ~ 0.5mm thick.

The fiber diameter concerned can be freely controlled. The new product can be continuously used at high temperature of 260°C and can tolerate heat of 300°C for a short time. It is also capable of resisting acids, alkalis and organic solvents.

The product has such a high porous ratio (70%) that it is suitable for separation/filtration of mixed liquids. It is nonadhesive, has a low dielectric constant and contains only small amounts of impurities including metal ions. At most 0.3ppm of impurities are detached thereform using a hydrothermal extraction process.

The two companies are considering applying the new product to industrial-use filters and electronics materials. Showa Industry is scheduled to produce fluorocarbon staple and Tomoegawa will transform it into nonwoven-type thin sheet. The product will be marketed via Showa Industry.

The production capacity concerned stands at 1,000m² a month and will be scaled up to 6,000m² a month in the near future. They have already supplied the sheet in sample form to a foreign company-affiliated filter maker.

4TH GENERATION ANTIBIOTIC ENTERS CLINICAL TESTING IN JAPAN, U.K.

Clinical Tests have begun in both Japan and the U.K. on a 4th generation cephalosporin antibiotic developed by Mochida Pharmaceutical Co. of Japan. It is Mochida's first self-developed drug to go into clinical testing abroad. The drug has proved to have a wider antibacterial spectrum than other cephem antibiotics termed 4th generation ones. It is, in particular, quite effective against such Gram-negative bacteria as Pseudomonas aeruginosa and Enterobacteriaceae which are difficult to combat, in addition to many Gram-positive bacteria. It remains effective for a long time in the body and may be administered by means of one shot a day.

It also has strong effects against Pseudomonas aeruginosa having resistance to Gentamicin and Ceftazidim and is reactive to Methicillin-resistant Staphylococcus. "It's an all-round antibacterial agent," says Vice-President N. Aizawa of Mochida.

If things go as planned, the drug may be put onto the market in both Japan and the U.K. by 1994. In Japan, Ajinomoto Co. with which Mochida has teamed up for drug development has established an efficient production method for the agent and is supplying the technical-grade product to Mochida. In the U.K., Glaxo will manufacture it with Mochida's technology and undertake clinical tests ien the near future.

YOSHITOMI STARTS CLINICAL TESTS ON AMERICAN ACE INHIBITOR

Yoshitomi Pharmaceutical Co. has revealed that it has commenced clinical tests in Japan on an angiotensin converting enzyme (ACE) inhibiter supplied by Warner Lambert of the U.S. The ACE inhibiter (common nar quinapril) has proved to have a stron action than captopril, one of chief A inhibiters so far available, and the co pany is intent on developing the s stance into an agent for treatment hypertension and cardiac insufficien

Quinapril is a new-type ACE inh iter without the SH-group of its eq valents and based instead tetrahydroisoquinoline. Outside Jap it has been granted manufactur approval in UK, Government appro is awaited in the U.S., and its clini testing is being planned in 20-odd cou tries.

It is expected, the company says, t one administration of the agent per d will be enough to stabilize blood pr sure. It also acts to increase the blo flow in the kidneys and the secreti and flow of urine, the company adds. addition, it is said to be as safe as en april, another ACE inhibitor.

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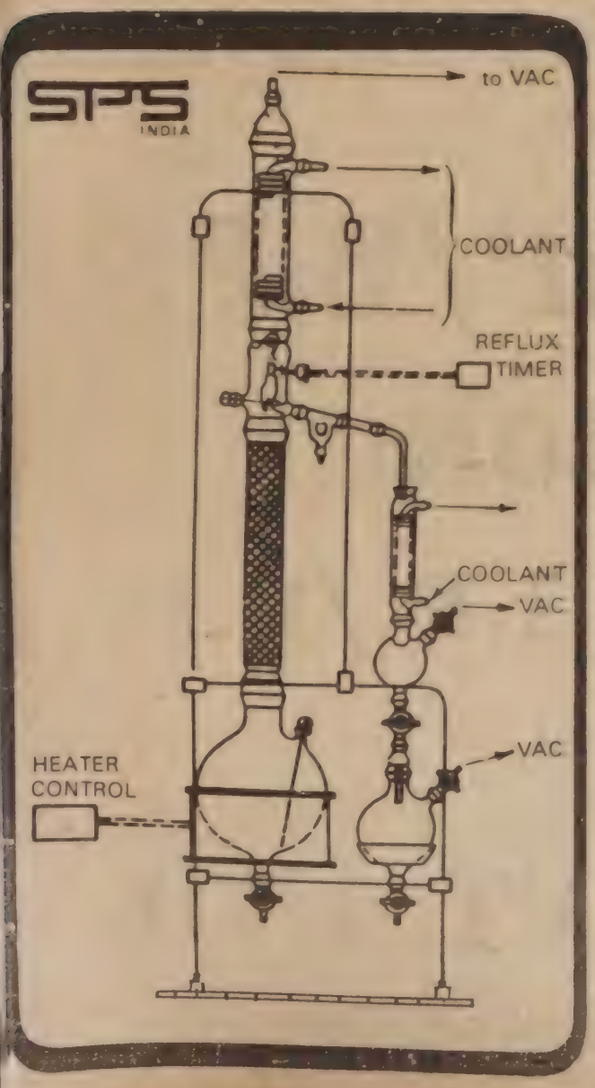

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MARKET INFORMATION

Downward Trend In Prices

Low trading activity prevailed in the Bombay market with activities coming to a standstill on 9/1 following the protests for abolition of octroi significantly. Thiourea and rangolite went down by Rs. 8 each to Rs. 78 and Rs. 70 respectively. Melamine (Czech) went up by Rs. 4 to Rs. 64 per kg following irregular supplies. In the dyes intermediates section there was a mixed trend.

Increase in basic price by one manufacturer pushed up prices of some intermediates while other intermediates came down marginally following easy availability. Export market for dyes seemed dull for the time being.

We cannot guarantee the accuracy of the prices published in CHEMICAL WEEKLY as they are based only on the enquiries made by our correspondent – and, as such they are not FIRM PRICES as between a buyer and seller. The prices are published only with a view to giving some ideas of the market conditions.

The prices are inclusive of Excise and Maharashtra Sales Tax.

(Prices as on January 9, 1990)

INDUSTRIAL CHEMICALS	Per Kg.
Ammonium sulphate	2.50
Ammonium phosphate (Mono)	14.50
Ammonium phosphate (Di)	14.00
Ammonium carbonate (Di)	17.00
Ammonium bicarbonate	5.60
Ammonium chloride	4.00
Ammonium nitrate	6.00
Arsenic white powder	22.00
Acrylamide (Resale)	70.00
Barium carbonate	8.00
Bleaching powder (33% Cl)	4.20
Borax (Granular)	18.00
Borax (Powder)	22.00
Boric acid (Tech)	26.00
Bisphenol-A	70.00
Butyl carbitol	110.00
Caustic soda (Flakes)	11.00
Caustic soda (Solid)	12.00
Caustic soda (Lye)	10.00
Calcium chloride 70% (Solid)	3.25
Calcium chloride 75-80%(fused)	3.50
Calcium chloride 36% (Anhydrous)	5.00
Calcium carbonate (precipitated)	4.25
Calcium carbonate (Activated)	4.75
Cobalt oxide	300.00
Cresylic acid	62.00
Camphor (Indian)	105.00
Cream of Tartar (Tech.) China	70.00
Citric acid (Belgium) (Resale)	47.00
Citric acid (Indian) (Resale)	47.00
Copper sulphate	25.00
Chromic acid	63.00
Ethylene urea	58.00
Ferric chloride (Lumps)	5.50
Ferric chloride (Anhydrous)	16.00
Glue flakes	15.00
Glue sheets	6.75
Gohsenol GH-17	110.00
Hydro	44+ST

Hyflosupercell	21.00
Hexamine (Resale)	35.00
Industrial Wax	25.00
Litharge	40.00
Lead Acetate (Tech.)	31.25
Lithopone	20.00
Magnesium chloride (Crystal)	3.00
Menthol crystal (Flakes)	900+Ex+ST
Menthol bold	665+Ex+ST
Menthol crystal cold	700+Ex+ST
Magnesium carbonate (Japan)	16.00
Magnesium carbonate (Indian)	18.00
Maleic Anhydride (Resale)	40.00
Mercury (34.5 Kgs)	10,500.00
Nickel chloride	110.00
Oxalic acid (Resale)	16.00
Peppermint oil (Rectified)	195+Ex+ST
Potassium carbonate (Indian)	25.00
Potassium carbonate (Imported)	33.00
Potassium bichromate	32.50+ST
Potassium phosphate (Mono)	14.00
Potassium phosphate (Di)	14.00
Polyvinyl alcohol (No. 117)	115.00
Polyvinyl alcohol (No. 173)	120.00
Polyvinyl alcohol (No 208)	150.00
Paraformaldehyde (Resale)	23.00
Phthalic anhydride 36% (Resale)	23.00
Pentaerythritol (Resale)	45.00
Paraffin wax	19+ST
Rangolite (German)	90+ST
Rangolite (Czech.)	70.00
Sodium sulphate (Fine)	6.00
Sodium sulphate (Coarse)	5.00
Sodium sulphide 50-52% (Flakes)	11+ST
Sodium sulphide 58-60% (Flakes) (TCL)	20.00
Sodium sulphide pure (Flakes)	12.25
Sodium nitrite (Resale) per 50 kg.	730.00
Sodium chlorite 80% (Spain)	84.00
Soda Ash (Tata)	4.80
Soda Ash (Birla)	4.50
Soda Ash (Imp.)	4.50
Sodium bicarbonate	7.50
Sodium bisulphite	4.50
Sodium silicate	3.00
Sodium acetate	8.00
Sodium alginate	320.00
Titanium Dioxide (Anatase)	80+ST
Titanium Dioxide (Rutile – RCR_2)	112+ST
Tartaric acid	100.00
Trisodium phosphate	5.50
Thiourea	78.00
Urea (Tech.)	2.90
Vacuum salt	1.00
Zinc Dust	32.00
Zinc Oxide	58.00
Zinc chloride powder (Tech.)	12.50
Zinc sulphate	7.00

SOLVENTS	Per Kg.
Acetic Acid Glacial (Resale)	14.00
Acetic Anhydride (Resale)	35.00
Acetone (Resale)	20.50
Adipic Acid	70.00
Aceto Acetanilide	55.00
Aniline Oil	47.00
Benzoate Plasticiser	62.00
Butyl acrylate	84+ST
Butyl stearate	45.00
Butanol	35+ST
Benzyl Alcohol	60.00
Benzyl Chloride	34.00
Benzo trichloride	16.00
Benzoyl chloride	22.00
Bromine Liquid	60.00
Chloroform	31.00
Carbon Tetrachloride	21.00
Cellosolve	58.00
Cyclohexanone	52.00
Cyclohexanol	58+ST
Diacetone (Resale)	34.00
Diethyl Oxalate	34.00
Diethyl glycol (DEG)	32.00
Dioctyl Phthalate	45.00
Diallyl Phthalate	46.00
Dimethyl Phthalate	28.00
Dioctyl Adipate	52.00
Dibutyl Adipate	42.00
Dipentene	15.00
Dimethylamine 40%	26.00
Dimethylamine 50%	30.00
Ethyl Acetate	20.00
Ethyl Acrylate	72.00
Ethylene Dichloride	14.50
Ethylene Glycol	38.00
Formic Acid (Imp.)	24.00
Formaldehyde (Resale)	7.50
Glycerine (CP)	55.00
Glycerine (IW)	53.00
Hydrogen Peroxide 50% (Resale)	26.00
Isopropyl Alcohol	29.00
Isobutyl Alcohol (Resale)	30.00
Monoethanolamine (Resale)	90.00
Melamine	60.00
Methyl Ethyl Ketone	64.00
Methyl Isobutyl Ketone	58.00
Methyl Acrylate	66.00
Methylene Dichloride (Resale)	16.00

Meta Cresol	45.00
Nitrobenzene	25.00
Nitric Acid (Conc.) (RCF)	2.50
Ortho Cresol	30+ST
Phenol (Resale)	36.00
Propylene Glycol	55.00
Polyethylene Glycol (No.200)	58.00
Polyethylene Glycol (No.400)	62.00
Polyethylene Glycol (No.500)	52.00
Polyethylene Glycol (No.1600)	54.00
Polyethylene Glycol (No.4000)	70.00
Polyethylene Glycol (No.6000)	85.00
Para Cresol	110.00
Styrene Monomer	38+ST
Sorbitol	14.00
Sulphuric Acid	2.80
Trichloroethylene	29.00
Triethanolamine (Resale)	71.00
Turpentine Oil (Germany)	8.00
Turkey Red Oil (50%)	20.00
Vinyl Acetate Monomer	47.50

SOLVENTS	Per Litre
Benzene	11.50
N-Heptane	10.50
N-Hexane	13.00
Methanol	9.50
Solvent Naphtha Heavy	10.50
Solvent Naphtha Light	8.50
Toluene	13.50
Xylene	18.00

DYES INTERMEDIATES (PRICES ARE WITHOUT TAX AND EXCISE)

Alphanaphthylamine	63.00
Alpha Naphthol (Imp.)	170.00
Aceto Acetic Ester (Methyl)	66.00
Ammonium Molybdate	210.00
Anthraquinone	120.00
Anthranilic Acid	78.00
2-Amino 4-Nitrophenol	140.00
Blue B. Base (Local)	257.00
Beta Naphthol (Atul)	75.00
Benzidine Dihydrochloride (BDH)	95.00
Bromamine Acid	550.00
BON Acid	130+Ex+Ta
Chicago Acid (Atul)	355.00
Coach Acid	52.00
C. Acid (Imp.)	210.00
Cyanuric Chloride	140.00
2,4- DNCB	30.00
Dihydrothio PTOS (Imp.)	1,000.00
Dimethyl Aniline	70.00
Diethyl Aniline	160.00
Diamino stilbene disulphonic acid	168.00
3,3-DCB (Imp.)	175.00
Gamma Acid (Atul)	205.00
H. Acid (Atul)	107.00
G. Salt	75.00
Isophthalic Acid	45.00
J. Acid	350.00
J. Acid Urea	410.00
K. Acid	125.00
MPDS (German)	185.00

Meta Ureido Aniline	230.00
MPD (Local)	205.00
MPD (Japan)	220.00
Naphthenic Acid	25.00
N-Methyl J. Acid	580.00
N-Methyl Aniline	125.00
Naphthalene (Refined)	23.00
Ortho Anisidine (OA) (Imp.)	108.00
Ortho Dichloro Benzene (ODCB)	16.00
OT Base	130.00
Para Dichloro Benzene (PDCB)	32.00
Para Anisidine (PA local)	160.00
PNA	120.00
Para Cresidine (Imp.)	410.00
Para Amino Azo Benzene (India)	150.00
PNCB	62.00
Para Amino Acetanilide	190.00
1-Phenyl 3-Methyl 5-Pyrazolone	140.00
Phenyl J. Acid	340.00
Para Amino Benzoic Acid	165.00
PT Base	140.00
Rhoduline Acid	550.00
Resist Salt 80%	28.00
Resorcinol	205.00
Sodium Naphthionate	67.00
5-Sulpho-Anthranilic Acid	80.00
Sulphanilic Acid	33.00
Sulpho Tobias Acid	170.00
Trichloro Benzene (TCB)	24.00
Tobias Acid	166.00
Metanilic Acid	43.00
MTD	120.00

Bombay Dyes Market

(Prices as on January 9, 1990)

ACID COLOURS	Per Kg.
Acid Violet 4BS	*190.00
Acid Maroon V	110.00
Acid Orange II	112,55
Acid Orange IIY	93.85
Acid Red A	137.00
Acid Scarlet 3R	128.35
Acid Red 3BN	*195.00
Acid Red R2R	132.00
Acid Red RS	88.00
Acid Patent Blue AS	*280.00
Acid Green V	*375.00
Acid Coomasi Blue	200.00
Acid Yellow 5GN	65.00
Acid Red PG	85.00
Acid Red GRS	78.00
Acid Black 10 BX	157.15
Acid Black BX	126.95
Acid Black Wax	135.50
Crosein Scarlet MOO	200.30
Procinil Yellow GS (ICI, UK)	265.00
Procinil Red GS (ICI, UK)	530.00
Procinil Blue RS (ICI, UK)	315.00
Procinil Scarlet G (ICI, UK)	600.00
Procinil Orange G (ICI, UK)	250.00
Procinil Rubine (ICI, UK)	550.00

* To get resale price add 6% tax

DIRECT COLOURS	Per Kg.
Yellow 3GX	114.00
Gun Yellow RCH	175.85
Fast Yellow GCH	171.50
Yellow CFG Hly. Conc.	721.00
Fast Yellow GS	126.96
Fast Yellow CHRS	116.85
Viscose Orange A	210.35
Fast Orange GR	171.50
Red	122.65
Dark Tan	98.15
Red IIR	98.15
Red 4B	217.55
Bordeaux BW	170.10
Fast Scarlet 4BS	223.50
Red 12B	220.45
Bordeaux Hly. Conc.	249.20
Cotton Red N	117.05
Brill. Fast Helio B	362.85
Brill. Fast Helio 2R	385.85
Brill. Fast Helio 2RS	177.30
Brill. Fast Helio BS	116.10
Brill. Violet Extra	181.45
Blue 2B	102.50
Blue G	220.45
Sky Blue FB	242.00
Copper Blue GR	190.25
Fast Greenish Blue GL	114.60
Developed Black BT	149.95
Blue NB-2B	348.45
Blue NB-2BG	214.70
Developed Black NB-GHB	214.70
Green B	142.75
Green NB-B	218.90
Green 2B-N	218.90
Brown MR	197.40
Brown CN	137.00
Golden Brown G	175.85
Catechin G	155.70
Omega Tan	161.45
Catechin GS	102.80
Black E Hly. Conc.	180.15
Black E Extra Hly. Conc.	180.15
Black NB-ER Hly. Conc.	290.50

DISPERSOL COLOURS	Per Kg.
Red B 3B Conc	611.50
Red B 2B Conc	797.90
Red CB Powder	1048.25
Red D2B Powder	589.85
Violet C 4R Conc.	1202.70
Blue BG Conc	580.65
Blue BN Powder	128.20
Blue D 2R Powder	588.25
Navy BT Conc	531.95
Blue B 2G Conc	577.95
Black BT Conc	319.50
Blue BR	482.40
Yellow 7GL	813.20
Yellow 5RX	269 90
Yellow 3G	473.20
Yellow	140.00
Yellow AL	167 20
Yellow Brown REL	311.70
Yellow FFL	571 40
Gold Yellow GG	320 80
Pink REL	593.00
Red BEL	615 60
Red 2B	422
Red FB	425
Red Violet FBL	622
Orange 3R	254
Violet 3R	370
Violet RL	355
Violet 6R	638
Scarlet RR	283
Rubine 3B	289
Rubine CB	449
Blue GL	419
Blue BGF	805
Navy Blue RE	359
Brown 3REL	272
Black GEL	420
Dark Brown 3B	411

BASE COLOURS	Per K
Fast Yellow GC	77
Fast Orange GC	128
Fast Scarlet R	198
Fast Scarlet RC	128
Fast Scarlet RCR	105
Fast Scarlet G	115
Fast Scarlet GN	92
Fast Scarlet GG	77
Fast Scarlet GGS	73
Fast Red B	233
Fast Red RC	115
Fast Red R Flakes	158
Fast Red TR	181
Fast Red TR Oil	223
Fast Red RL	251
Fast Red KB Oil	251
Fast Bordeaux GP	236
Fast Garnet GBC	103
Fast Violet B	548
Fast Blue BB	566

NAPHTHOL COLOURS	Per Kg
ASG	301
AS	205
ASSW	379
ASBS	253.7
ASBO	266
ASD	209
ASOL	243

STR	369.00
SPH	336.05
SE	236 00
SEL	249.95
SLB	2002.35
SBT	2459.45
SWG	143.00
SSG	538.65
SSR	652.60

ROCION COLOURS	Per Kg.
olden Yellow HR	207.95
rill. Yellow H4G	145.65
upra Yellow H 8GP	168.55
rill. Yellow HE6G	214.75
ellow G-E4R	276.05
rill. Yellow H7G	332.30
ellow M4R	275.45
ellow MGR	387.65
rill. Yellow M4G	201.15
rill. Yellow M8G	366.10
ellow M3R	244 70
rill. Orange H2R	303 80
rill. Red H7B	157 95
rill. Orange M2R	313.15
rill. Red H8B	213.55
rill. Scarlet H RN	245 05
upra Red H-3BP	179.80
rill. Red H-F3B	243.45
rill. Magenta HB	182.00
rill. Red M 5B	160.05
rill Red M 8B	218 35
rill Pink MB	137.10
rill. Magenta MB	163 65
rill. Purple H-3R	219.55
rill. Purple H-7R	175 40
avy Blue H 3R	333 75
rill Blue H-GR	406.40
rill. Blue H5G	207.95
lue H 5RX	286.20
rill. Blue H 7G	213.95
rill Blue H 7RX	358.15
urquoise HA	265.05
upra Blue H-3RP	595 30
upra Turquoise H 2G P	181 50
Blue H-FRD	305.80
Navy Blue H3R	333.75
Blue H 5RX	286.20
Navy Blue M3R	355.70
Brill. Blue MR	405.60
Brill. Blue M RX	214.20
Brill. Blue M-G	226.45
Blue M 4GD	369.40
Navy Blue M RB	341.85
Turquoise M-G	240.30
Brill. Blue M GX	516.25
Blue 3R Acra Powder	718.20
Dark Brown H 6R	248.45
Cobalt Oxide	285.00
Green H4BD	287.00
Green H-E4BI	169.80
Red Brown H IF	143.25
Orange Brown H 28	209.05
Brown M GRN	188.80
Black H-N	314.20

SULPHUR COLOURS	Per Kg.
Navy Blue	210.35
Green G	194.55
Black Grains Extra	72.25
Black Grains OG	73.70
Black GXE Conc.	70.85
Black GXE	57.90
Black GXR	69.40
Black Grains 800	62.80
Black EXR Grains	73.70
Black EXR Grains 800	59.35

VAT COLOURS (ICI)	Per Kg.
Yellow 5G Supra Disperse	561.85
Yellow 5G Acra Conc	818.60
Gold Orange 3G Pdr. Fine	1158.45
Brill. Orange 6R Pdr. Fine	624.35
Gold Orange 3G Supra Disp	693.85
Brill. Orange 6RX Powder	394.30
Brill. Red 3B Pdr. Fine	1214.15
Brill. Red 3B Supra Disp	867.45
Brill. Purple 3R Acra Powder	827.05
Brill. Purple 2R Hly Conc.	744.25
Brill. Purple 4R Supra Disp.	604.25
Brill. Purple 2R Acra Conc.	779.85
Blue 2R Powder Fine	675.30
Blue BC Acra Con Pdr. Fine	1013.15
Blue BC Conc. Pdr. Fine	713.65
Blue R Conc. Pdr. Fine	719.70
Blue Conc. Powder	645.80
Brill. Blue 2R Hly. Conc.	378.55
Blue RR Supra Powder	629.35
Brill. Blue 2R Supra Disp.	115.65
Dark Blue 2R Powder Fine	512.65
Blue BC Supra Disp.	419.65
Jade Green XBN Powder Fine	555.80
Jade Green XBN Acra Conc. Pdr	1026.05
Jade Green 2G Pdr. Fine	533.25
Jade Green 2G Ptg. Paste	125 40
Jade Green XBN Ptg. Paste	126.00
Jade Green 2G Supra Disp.	618.00
Olive D Pdr. Fine	563.90
Olive Green B Supra Disp.	421.70
Jade Green XBN Supra Disp. (N)	327.30
Olive OMW Powder Fine	698.55
Olive OMW Supra Disp.	538.05
Olive D Supra Disp.	361.70
Olive R Supra Disp.	470.25
Olive D. Ptg. Paste	193.00
Olive Green B Ptg. Paste	199.10
Olive Green B Acra Conc.	741.10
Olive R Acra Conc.	779.85
Brown R Pdr. Fine	869 45
Dark Brown 3R Fine	826.25
Brown G Supra Disp.	582.05
Brown 2G Supra Disp.	716.10
Brown R Supra Disp	547.35
Brown BR Powder	867.75
Dark Brown 3R Ptg. Paste	217.15
Dark Brown 3R Supra Disp	529.60
Brown G Acra Conc.	967.95
Brown M. Powder Fine	768.80
Grey M. Supra Disp.	585.45
Blue BC Acra Conc. Pdr. Fine	762.70
Direct Black AC Supra Disp.	415.75
Direct Black AC Pdr. Fine	574.70
Direct Black CH Supra Disp.	490.45
Direct ACD Ptg. Paste	217.15

Delhi Market

DELHI: JAN. 5, (NNS) Mercury jumped sharply by Rs. 300 at Rs. 11,000 per flask in the Delhi chemicals market during last week, due to acute shortage of stock in the market as well as higher advices from Bombay. In Bombay mercury hardened sharply from Rs. 10,400 to Rs. 10,700. Sodium sulphate Gwalior rayon registered a rise of Rs. 200 at Rs. 3,400 per tonne in view of hike in its prices by manufacturers. Sodium nitrite remained steady at Rs. 800/900 due to tight stock position.

Chatkolite and sufolite slumped by Rs. 2/3 at Rs. 62 and Rs. 72 per kg respectively thanks to good offerings from Bombay. Rangolite Germany moved down from Rs. 85 to Rs. 84 followed by lower advices from Bombay. It is noticeable that in the last week of Oct. 89, prices of rangolite were quoted higher at Rs. 120. Demand was negligible from industrial units induced by power crisis in the capital.

Citric acid small dropped by Rs. 100 at Rs. 2,050 per 50 kg, due to fall in consumption and lower advices from Bombay. Citric acid bold of Bombay Dyeing slipped by Rs. 25 at Rs. 2,350. As a result of improved supply, soda bicarb eased by Rs. 5 at Rs. 285/290 per 50 kg.

On reports of about 34 tonnes of imported goods arriving in the market, hydrogen peroxide eased by 50 paise at Rs. 26/26.50. Formic acid softened by Re. 1 at Rs. 24 due to increased offerings. In the absence of demand from plastic and paints units, titanium dioxide anatase and K-brand declined by Re. 1 each at Rs. 82 and Rs. 75 per kg. Titanium dioxide RCR-2 slipped by Rs. 2 at Rs. 110 in the absence of enquiries while RC-822 ruled quiet at Rs. 98 per kg. Zinc oxide nosedived by Rs. 4,000 at Rs. 42,000/48,000 per tonne in the absence of demand.

Menthol flake medium and bold slipped by Rs. 6/10 at Rs. 352, Rs. 375 and Rs. 390 per kg respectively, in the absence of enquiries by exporters. Due to acute shortage of power in the capital, mentha oil dropped by Rs. 13 at Rs. 252/272 per kg. No change was reported in dyes and colours during the week.

(DELHI MARKET RATES AS ON JANUARY 5, 1990)

Ammonia Bicarb (Per 25 Kg.)	140.00
Mercury (Per flask)	11,000.00
Soda ash (Per bag)	340/346.00
Ammonium Chloride (50 Kg.)	110/180.00
Caustic soda flakes (50 Kg.)	475.00
Citric acid (Per 50 Kg.)	2,050/2,350.00
Stable Bleaching Powder Shriram (Per 25 Kg.)	101.00
Stable Bleaching Powder KCI (Per 25 Kg.)	90.00
Stable Bleaching Powder Maruti (Per 25 Kg.)	90.00
Stable Bleaching Powder Modi (Per 25 Kg.)	92.00
Sodium Bicarbonate (50 Kg.)	285/290.00
Sodium Hydrosulphite (Per Kg.)	34.00/36.50
Rangolite (Per Kg.)	84.00
Tartaric acid (Imp) (50 Kg.)	13,700.00
Sufolite (per Kg.)	72.00
Chatkolite (per Kg.)	62.00
DMO	120.00
Boric acid Technical (Per 50 Kg.)	1,400.00
Paraffin Wax (Per 50 Kg.)	880.00
Tartaric Acid (Indian Per 15 Kg.)	4,150.00
Borax Granular (Per 50 Kg.)	835.00
Borax Crystal (Per 50 Kg.)	835.00
Sodium Nitrite (Per 50 Kg.)	800/900.00
Sodium Nitrate (Per 50 Kg.)	450.00
Camphor Thal (Per Kg.)	103.00
Camphor Powder (Per Kg.)	93.00
Menthol Bold (Per Kg.)	390.00
Menthol Medium (Per Kg.)	375.00
Menthol Flake (Per Kg.)	352
Menthol Oil (Per Kg.)	252/272
Glycerine (Per Kg.)	55/58
Sodium Silicate (Per quintal)	275/350
Hexamine (Per Kg.)	35
Acetic Acid Glacial (Per Kg.)	15
Copper Sulphate (Per quintal)	2,400/2,
Formic Acid (Per Kg.)	24
Formaldehyde (Per Kg.)	8
Hydrogen Peroxide (Per Kg.)	26/26
Calcium Carbonate (Per Tonne)	2,500/4,0
Acid Slurry Soft (Per Kg.)	28
Acid Slurry Hard (Per Kg.)	38
Phosphoric Acid (Per 50 Kg.)	1,050
Potassium Nitrate (Per quintal)	900/1,200
Potassium Permanganate (Per 50 Kg.)	2,800/3,200
Sodium Bichromate (Per 50 Kg.)	1,575/1,600
Trisodium Phosphate (50 Kg.)	600
Titanium Dioxide Anatase (Per Kg.)	82
Titanium Dioxide RC-822 (Per Kg.)	98
Titanium Dioxide K-Brand (Per Kg.)	75
Titanium Dioxide RCR-2 (Per Kg.)	110
Zinc Oxide (Per metric tonne)	42,000/48,000
Phenol Carbolic Acid (Per Kg.)	37
Carbon Tetrachloride (Per Kg.)	24
Chloroform (Per Kg.)	28
Sodium Sulphate (Per metric tonne)	3,400/3,700
Naphthalene Balls (Per 50 Kg.)	1,500

DYES & COLOURS	(Per Kg
Naphthol AS	175/201
Naphthol ASG	180/295
Naphthol ASBS	210/248
Naphthol ASTR	275/360
Naphthol ASOL	210/238
Naphthol ASBO	195/260

DIRECT DYES	(Per Kg
Black E. Conc.	120/176
Diazo Black B.T.	105/147
Green B	90/140
Blue 2-B	60/101
Blue 2-B 225% (JNR)	125
Sky Blue FB	160/235
Basic Auramine	55/110
Basic Rhodamine	300/425
Basic Methylene Blue	100/180
Basic Violet	165/210
Basic Malachite Green	175
Acid Orange	75/111
Congo Red H/C	75/120

International Bulk Chemical Prices

Spot Prices are as on December 13, 1989

Naphtha prices have shot up to $172-174/ton cif NWE. Though demand has been dull, strong crude and oils prices have caused this spurt. Ethylene remained tight in supplies with major plants facing technical problems. Propylene too remained tight in supplies with prices being quoted at $323-335 cif. Weak butadiene demand have caused prices to plummet to $520-560/ton. Benzene prices slipped to $385-395/ton fob NWE. Toluene was also negligibly traded in with prices at around $250-260/ton fob. Paraxylene continue its downward slide with prices around $510-525/ton fob. Orthoxylene continued at its low levels around $290-295/ton fob NWE with no signs of an upswing. Strong supplies with weak ing demand pushed xylene prices lower, with solvent quoting at $265-270/ton and virgin at 265-275/ton fob. Shortage of ready materials prompted styrene prices to firm to $740/ton cif NWE. Methanol also firmed up to $109-112/ton fob for T2 and $95-100/ton cif for T1 following low inventories.

Product	European Spot price range $/ton	US price range $/ton
Ethylene	310-335 (cif)	463 (spot)
Propylene (100% basis)	323-335 (cif)	276-286 (spot)
Butadiene	520-560 (fob)	573 (spot)
Benzene	385-395 (fob)	396-399 (spot)
Toluene	250-260 (fob)	237 (spot)
Xylenes (virgin)	265-275 (fob)	264-266 (spot)
(solvent)	265-270 (fob)	n.a.
Styrene	780-785 (T2)(fob)	694-705 (spot)
	725-740 (T1) (cif)	
Paraxylene	510-525 (fob)	n.a. (spot)
Orthoxylene	290-295 (fob)	n.a. (spot)
Ammonia	88-102 (cif)	n.a.
Methanol	109-112 (T2)(fob)	n.a.
	95-100 (T1)(cif)	
Naphtha	172-174 (cif)	n.a.

Shipping News

VESSELS DUE IN BOMBAY FOR EXPORT LOADING

Due Date (1)	Steamer's Name & Flag (2)	Agents (3)	Will load for (4)	Approx. sailing dt. (5)
12/1	Eagle Nova	F.F.C. Co.	Jeddah; P. Sudan; Hodeidah. (Carting at Timber Pond No. 1).	17/1
20/1	CMB Eager (Nhava Sheva)	C.M.B.	Djibouti; Port Sudan; Jeddah; La Spezia; Valencia; Genoa; Barcelona; Marseilles; Tunis; Casablanca; Tangier; Alexandria; Piraeus; Mersin; Limassol; Felixstowe; London; Liverpool; Manchester; Birmingham; Avonmouth; Dublin and all inland destinations in U.K.; Antwerp; Rotterdam; Hamburg; Bremen; Leixoes; Lisbon; Copenhagen; Oslo; Gothenburg; Stockholm; Malmao; Aarhus; Helsinki. (Carting at Kalamboli).	22/1
13/1	Seacrest Achiever (Ger)(V-205)	Merzario/	Jeddah; Hodeidah; P. Sudan; Ravenna, Ancona; Piraeus; Venice; Trieste. (Carting at M.O.D. No.2).	19/1
		Seaspeed/	Tilbury; London; Felixstowe; Manchester; Liverpool; Avonmouth; Le Havre; Rotterdam; Hamburg; Antwerp; Bremerhaven and Scandinavian ports. (Carting at Hay Bunder No. 5).	
		L. Triest/	Jeddah; Trieste; Venice; Ravenna; Rijeka; Naples. (Carting at M-171/173 C.D.).	
		Oceanic/	P. Said; Limassol; Alexandria; Casablanca; Tripoli; Livorno; Genoa; Mersin; Iskendren; Izmir. (Carting at Wadi Bunder No. 3).	

(1)	(2)	(3)	(4)	(5)
		Killick	Jeddah; Felixstowe; London; Liverpool; Manchester; Bristol; Avonmouth; Leeds; Glasgow; Tilbury; Birmingham; Dublin; Belfast; Rotterdam; Hamburg; Le Havre; Antwerp; Bremen; Bremerhaven; Fos; Valencia; Marseilles; Barcelona and Scandinavian ports. (Carting at M-178/180 Cotton Depot).	
15/1	Olandia (Ger)	Samrat/ Hindustan/ Merzario	Felixstowe; Hamburg; Rotterdam also London; Liverpool; Leixoes; Lisbon; Manchester; Avonmouth; Wembly; Birmingham; Leicester; Le Havre; Amsterdam; Bremen; Antwerp; Copenhagen; Leeds; Aarhus; Gothenburg; Oslo; Stockholm; Helsinki; Belfast and all destinations in U.K. Benelux Germany; Italy; France; Switzerland and Austria. (Carting at M.O.D. No. 2 for Merzario) (Carting at M.O.D. No. 1 for Samrat and Hindustan).	22/1
15/1	Medipas Wave	L. Triest/	Jeddah; Barcelona; Marseilles; Genoa; Leghorn; La Spezia; Naples; with TP Trieste; Venice; Ravenna; Bari; Koper; Rijeka; Las Palmas; Santacruz De Teneriffe; Malta; Limmassol; Alexandria; Casablanca; Tunis; Algiers; Lattakia; Tripoli; Benghazi; Oran; Point E Pitre; Port De France. (Carting at M-171/173 Cotton Depot).	22/1
		Samrat/ Hindustan/	Barcelona; Marseilles; La Spezia; Livorno; (Leghorn); Genoa; Naples and other Italian ports and FCL only Beirut; Alexandria; Valletta; Lattakia; Mersin. (Carting at M.O.D. No. 1 for both).	
		Merzario	Genoa; Leghorn; La Spezia; Naples; Salerno; Marseilles; Barcelona. (Carting at M.O.D. No. 2).	
17/1	Yulius Fuchik (Rus) (V-105 W/B)	Transocean	Odessa; Izmail; Reni (U.S.S.R.); Russe; Bulgaria; Budapest (Hungary); Linz; Vienna (Austria); Bratislava (Czechoslovakia); Deggendorff; Regensborg (West Germany) (all ports on River Danube). (Carting at N/O-PD & G-PD).	18/1
16/1	Maersk Clementine	Volkart Fleming	Leghorn; Marseilles; Naples; Barcelona; Bilbao; Bordeaux; Alicante; Genoa; Valencia; Bremen; Jeddah; Antwerp; Rotterdam; Bremerhaven; Hamburg; U.K. and Scandinavian ports. (Carting at M.O.D. No. 3).	20/1
17/1	CMB Enterprise	C.M.B.	Antwerp. (Carting at Kalamboli).	19/1
12/1	Eagle Nova	F.F.C. Co.	Colombo; Rangoon. (Carting at Timber Pond No. 1).	17/1
15/1	Medipas Wave	L. Triest	Colombo. (Carting at M-171/173 Cotton Depot).	22/1
10/1	Maribor (Yug)	Depe	Hongkong; Keelung; (Kaohsiung); Kobe; Yokohama; Tokyo; Busan. (Carting at CFS Cotton Avenue for containers only)	17/1
12/1	Eagle Nova (V-06)(Cyp)	F.F.C. Co.	Penang; P. Kelang; Singapore; Bangkok; Jakarta; (T. Priok); Hongkong; Manila; Busan; Keelung; Kaohsiung; Kobe; Yokohama; Nagoya; Osaka; Tokyo; Tsingtao; Dairen; Quangzhou; Whampoa; Shanghai; Hsingkang. (Carting at Timber Pond No. 1).	17/1
12/1	Nikolay Semashko	Transocean	Penang; Singapore; Bangkok; Main Japan Ports.	22/1
16/1	Maersk Clementine (Sing)(V-9002)	Volkart Fleming	Penang; Singapore; Hongkong; Keelung; Kaohsiung; Busan; Main Japan Ports; Manila; Jakarta; Surabaya; Bangkok; P. Kelang; Chinese Ports. (Carting at M.O.D. No. 2).	20/1
17/1	Uni Pioneer (V-021)(Pan)	Greenways	Singapore; Penang; Port Kelang; Bangkok; Djakarta; Surabhaya; Manila; Cebu; Kaohsiung; Keelung; Osaka; Yokohama; Kobe; Shimizu; Moji; Nagoya; Pusan; Hongkong. (Carting at G/H Cotton Depot).	20/1
12/1	Eagle Nova	F.F.C. Co.	Brisbane; Fremantle; Sydney; Melbourne; Adelaide. (Carting at T.P. No. 1)	17/1
18/1	Vega	O.S.A.	Sydney; Melbourne; Adelaide; Brisbane; Fremantle; Auckland; Wellington; Lyttelton; P. Chalmers. (Carting at M-178/180 C.D.).	23/1
9/1	Rossana (V-39W)	Mackintosh	Muscat; Dubai. (Carting at 6-VD).	17/1
9/1	Al Zahraa (Iraqi)	Al Rafidain	Umm Qaser. (Carting at 12-VD).	18/1
12/1	Sun Set	Worldlink	Dubai; Kuwait.	18/1
12/1	Eagle Nova (V-06)	F.F.C. Co.	Dubai; Sharjah; Abu Dhabi; Doha; Muscat; Dammam; Riyadh; Bahrain; Kuwait. (Carting at Timber Pond No. 1).	17/1
13/1	Seacrest Achiever (V-205)	Parekh/	Muscat; Dubai; Sharjah; Abu Dhabi; Bahrain; Dammam; Kuwait; Baghdad. (Carting at Hay Bunder No. 4).	19/1
		Merzario/	Dubai; Sharjah; Abu Dhabi; Muscat; Doha; Dammam; Kuwait; Bahrain. (Carting at 14-VD for Merzario)	
		L. Triest/	Dubai; Dammam; Riyadh; Muscat; Abu Dhabi; Doha; Kuwait; Bahrain. (Carting at 171/173 Cotton Depot for L. Triest).	

(1)	(2)	(3)	(4)	(5)
		Sai Ship/ Seaspeed	Dubai; Muscat; Sharjah; Abu Dhabi. (Carting at Wadi Bunder No. 3). Dubai; Dammam; Bahrain; Kuwait; Doha. (Carting at H.B. No. 5).	
16/1	Maersk Clementine	V. Fleming	Dubai; Dammam; Muscat; Bahrain; Kuwait; Riyadh; Doha. (Carting at M.O.D. No. 2).	20/1
20/1	CMB Eager (Nhava Sheva)	C.M.B.	Dubai; Abu Dhabi; Bahrain; Kuwait; Dammam; Doha. (Carting at Kalamboli)	
14/1	Kapitan Medivertskiy	Sai Ship	Mombasa; Dar Es Salaam. (Carting at W.B. No. 3).	18/1
20/1	CMB Eager (Nhava Sheva)	C.M.B.	Dar Es Salaam; Mombasa (Direct); Nacala; Tanga; Kampala; Blantyre; Lusaka; Ndola; Matwara; Lilongwe; and all inland destinations in East Africa. (Carting at Kalamboli).	22/1
20/1	CMB Eager (Nhava Sheva)	C.M.B.	Norfolk; New York; Baltimore; Philadelphia; Charleston; Savannah; Houston; Miami; New Orleans; Via Antwerp; Montreal; Toronto; Halifax. (Carting at Kalamboli).	22/1
13/1	Seacrest Achiever (V-205)	Seaspeed/ Oceanic	New York; Baltimore; Norfolk; Savannah; Charleston; Houston and S. American ports. (Carting at Hay Bunder No. 5). New York; Baltimore; Philadelphia; Chicago; Boston; Norfolk; Atlanta; Charleston; Savannah; Miami; Houston and other inland destinations in U.S. East Coast and S. American ports. (Carting at Wadi Bunder No. 3).	19/1
15/1	Medipas Wave	Samrat/ Hindustan/ L. Triest	Boston; New York; Baltimore; Norfolk; Charleston; P Mouth; P. Lauderdale; Miami; New Orleans; Savannah; Jacksonville; P. Everglades; Philadelphia; Halifax; Montreal; Toronto and S. American ports. (Carting at M-171/173 Cotton Depot for L. Triest) (Carting at M.O. D. No. 1 for Samrat and Hindustan).	22/1
16/1	Maersk Clementine (Sing)(V-9002)	Volkart Fleming	New York; Philadelphia; Baltimore; Norfolk; Charleston; Savannah; Jacksonville; Miami; New Orleans; Houston; Toronto; Montreal; Chicago; Atlanta; Denver; Dallas; Wilmington; Milwaukee; Detroit; Mineapolis; Memphis; Nashville; Cleveland; Phoenix; Boston; Los Angeles; Vancouver; Seattle; San Francisco; Portland; Longbeach; Mexican and S. American ports. (Carting at MOD No. 2).	20/1
12/1	Eagle Nova (V-06)	F.F.C. Co.	Los Angeles (Harbour); Longbeach; San Francisco; Oakland; Seattle; Vancouver (B.C.); Portland; New York; Boston; Norfolk; Baltimore; Charleston; Savannah; Miami; New Orleans; Houston; Montreal; Toronto; Fortworth; Chicago; Nashville; Atlanta; Philadelphia; Milwaukee; Kansas City; Phoenix; Guam; Dallas; Cleveland; St. Louis; Cincinnati; Denver; Louisville; Memphis; Wilmington (B.C.); San Diego; Mineapolis; Indianapolis and Central American ports; Honolulu. (Carting at Timber Pond No. 1).	17/1
18/1	Vega (V-09A/B)	O.S.A.	New York; Baltimore; Philadelphia; Houston; Boston; Chicago; Dallas; Atlanta; Savannah; Norfolk; Charleston; Los Angeles; San Francisco; Oakland; Seattle; Vancouver; Toronto; Montreal; Portland; Tacoma and S. American and W. Indies Ports. (Carting at M-178/180 Cotton Depot).	23/1
20/1	CMB Eager (Nhava Sheva)	C.M.B.	Lagos; Abidjan; Lome; Douala; Matadi; Port Gentil; Pointe Noire; Nouakchott; Cotonou; Dakar; Luanda; Monrovia; Tema via Antwerp. (Carting at Kalamboli).	22/1
13/1	Seacrest Achiever	Seaspeed	West African ports. (Carting at Hay Bunder No. 5).	19/1
15/1	Medipas Wave	L. Triest	With T.P. Lagos/Apapa; Abidjan; Dakar; Douala; Cotonou; Nouakchott; Libreville; Tema; Matadi; Conakry; Freetown. (Carting at 171/173 Cotton Depot).	22/1
15/1	Olandia	Merzario	Dakar; Abidjan; Monrovia; Lome; Douala; P. Noire; Matadi; Libreville; Cotonou; P. Gentil; Lagos; P. Harcourt; Warri; Freetown; Conakry; Louanda; Nouakchott; Guinea Blassa. (Carting at M.O.D. No. 2).	22/1
16/1	Maersk Clementine	V. Fleming	Lagos/Apapa; Dakar; Freetown; Monrovia; Lome; Cotonou; Douala; Tema. (Carting at M.O.D. No. 2).	20/1

VESSELS DUE IN BOMBAY FOR IMPORT DISCHARGE

Due Date	Steamer's Name	Agents	From
17/1	CMB Enterprise (Nhava Sheva)	C.M.B.	U.K. Cont./U.S./Med./E. Africa
20/1	Chandidas	S.C.I.	U.K. Cont./U.S.
23/1	Ind. Faith	I.S.S. Co.	U.K. Cont.
18/1	Ibn Al Moataz	Transworld	S. America
21/1	Jag Yamuna	I.S.S. Co.	U.K. Cont.
21/1	Jala Gopal	S.C.I.	U.S./Canada
19/1	Lanka Aruna	Seahorse	U.K. Cont.
24/1	Regine	Sai Ship	Cont./Med.
19/1	Vishva Kaumudi	S.C.I.	U.K. Cont.
20/1	Vishva Mamta	S.C.I.	Cont./Med.
18/1	Vega (V-09)	O.S.A.	Far East/U.S.
		M.S.P.L.	Far East
17/1	Yulius Fuchik (V-105)	Transocean	Russia/E. Europe

Materials Imported

BOMBAY
(From 28.11.89 to 29.11.89)

ACETOPHENONE 99%: From RG: Kantilal Manilal and Co., 1,000 gs., Rs. 19,567.

ACRYLAMIDE: From Japan: Alok nthetics Pvt. Ltd., 1,000 Kgs., s. 25,431; Amir Synthetic Carbamide vt. Ltd., 1,000 Kgs., Rs. 25,431; shok Screen Designers, 1,000 Kgs., s. 25,431; Gira Enterprises, 1,000 gs., Rs. 25,431; Glyco Products India vt. Ltd., 1,000 Kgs., Rs. 25,431; Gopi ynthetics Limited, 1,000 Kgs., s. 25,431; From Japan: Jain Enterpri-es, 1,500 Kgs., Rs. 3,81,469; Jayshri hemical Inds., 1,000 Kgs., Rs. 25,431; loble Chem Inds., 2,000 Kgs., s. 50,862; Omkar Textile Mills Ltd., ,000 Kgs., Rs. 25,431; Patidar Tex-les, 1,000 Kgs., Rs. 25,431; Rajaswi hemical Mfg. Inds., 1,000 Kgs., s. 25,431; Rajaswi Polychem Inds., ,000 Kgs., Rs. 25,431; Saichem Indus-ries, 1,000 Kgs., Rs. 25,431; Venus nterprises, 1,000 Kgs., Rs. 25,431.

ADIPIC ACID: From Brazil: Anil nd Co., 5,000 Kgs., Rs. 1,84,986.

ALUMINIUM OXIDE: From FRG: ECE Industries Ltd., 250 Kgs., Rs. 45,361.

ALUMINIUM OXIDE SYNTHE-TIC: From Japan: Grindwell Norton td., 1,000 Kgs., Rs. 4,37,689.

2-AMINO 3-BROMO 5-NITRO BENZO NITRILE: From Japan: Sandoz India Ltd., 1,600 Kgs., Rs. 5,92,493.

ANTIMONY TRIOXIDE: From Belgium: Dr. Beck & Co., 250 Kgs., Rs. 13,669.

AROMATIC CHEMICALS: From FRG: Kanta Chemical Co., 125 Kgs., Rs. 68,775; Seth Brothers Perfumers Pvt. Ltd., 70 Kgs., Rs. 56,962.

ARSENIC TRIOXIDE: From Fin-land: Mahalakshmi Glass Works Ltd., 14.4 Kgs., Rs. 81,298.

4-B ACID: From Japan: Colour Chem Ltd., 4,000 Kgs., Rs. 2,95,165.

BENZYL OXYPHENBUTAZONE: From UK: Pragati Chemicals, 1,200 Kgs., Rs. 5,17,217.

BON ACID: From China: Dalal Enterprises, 2,000 Kgs., Rs. 1,86,495.

1,4 BUTENE DIOL: From USA: Excel Industries Ltd., 16,394.96 Kgs., Rs. 12,21,543.

CAPROLACTAM: From Belgium: J.K. Synthetics Ltd., 4,940 Kgs., Rs. 1,51,82,915; From Brazil: Garware Nylons Ltd., 250 MTs., Rs. 71,41,923; From Netherlands: The Baroda Rayon Corpn. Ltd., 153 MTs., Rs. 46,43,231; From Spain: J.K. Synthetics Ltd., 1,875 Kgs., Rs. 5,22,525; From USA: Garware Nylons Ltd., 125 MTs., Rs. 32,84,865.

CARBON BLACK: From FRG: Garware Paints Ltd., 900 Kgs., Rs. 1,63,299; Goodlass Nerolac Paints Ltd., 3,600 Kgs., Rs. 5,87,557; Rapicut Carbides Ltd., 2,500 Kgs., Rs. 64,484; From UK: The Standard Batteries Ltd., 600 Kgs., Rs. 1,14,558; From USA: Goodyear India Ltd., 2,721.6 Kgs., Rs. 34,194.

3,3-CHLOROPROPANOLAMINE 1-N-N-DIETHYLAMINO BENZOL: From Switzerland: Sandoz India Ltd., 1,600 Kgs., Rs. 11,83,247.

CITRIC ACID MONOHYDRATE BP: From China: Gayatri Labs Pvt. Ltd., 1,800 Kgs., Rs. 3,85,175.

PARA CUMIDINE: From Japan: Hoechst India Ltd., 3,040 Kgs., Rs. 22,78,579.

2-CYANO 4-NITRO ANILINE: From China: Serene Dyestuff Inds. Ltd., 250 Kgs., Rs. 3,72,992; From Hong Kong: Nirup Synchrome Limited, 2 MTs., Rs. 8,89,945.

2-CYANOPYRAZINE 99%: From Japan: Suchem Laboratories, 800 Kgs., Rs. 4,64,164.

DICYANDIAMIDE: From FRG: Cibatul Ltd., 200 Kgs., Rs. 72,933.

DIMETHYL CARBONATE: From France: Ganesh Medicament Pvt. Ltd., 1,000 Kgs., Rs. 3,52,644.

DIMETHYL C12/C14 AMINE: From FRG: Flame Pharmaceuticals Ltd., 3,040 Kgs., Rs. 1,31,944.

DIMETHYL DICHLORO SILANE: From FRG: Cadila Laboratories Ltd., 3,000 Kgs., Rs. 1,21,407.

TERTIARY DODECYL MERCAPTAN: From USA: Synthetics and Chemicals Ltd., 13.94 MTs., Rs. 2,96,637.

EPICHLOROHYDRIN: From Japan: Excel Industries, 15.84 MTs., Rs. 4,35,657; Pragati Chemicals Pvt. Ltd., NA, Rs. 4,79,572.

GAMMA FERRIC OXIDE: From USA: Jai Electronic Inds. Pvt. Ltd., 1,000 Kgs., Rs. 45,776.

HEXAMETHYL DISILAZANE: From FRG: Gujarat Lyka Organics Ltd., 2,170 Kgs., Rs. 3,86,112.

N-HEXANE 99%: From FRG: Spectrochem Pvt. Ltd., 264 Kgs., Rs. 29,351.

HYDROFLUORIC ACID: From FRG: Bharat Heavy Electricals Ltd., NA, Rs. 52,439; From USA: Bharat Electronics Ltd., 15,968 Kgs., Rs. 5,02,096.

HYDROXY CITRONELLAL: From France: Oriental Aromatics, 1,010 Kgs., Rs. 23,117.

IODINE CRUDE: From China: Eskay Fine Chemicals, 290 Kgs., Rs. 6,35,781.

ISOBUTYL BENZENE: From UK: Concept Laboratories Pvt. Ltd., 13,680 Kgs., Rs. 7,83,208.

METHYL BETA NAPHTHYL KETONE: From Switzerland: Industrial Perfumes Ltd., 480 Kgs., Rs. 1,96,584.

METHYL DIETHANOLAMINE: From USA: TPT, 119.95 MTs., Rs. 52,45,428.

METHYL METHACRYLATE MONOMER: From Sri Lanka: Mars

Plastics & Polymers Pvt. Ltd., 16 MTs., Rs. 1,69,988.

2-NITRO 1-CHLOROBENZENE 4-SULPHONIC ACID N-METHYL-AMIDE: From France: Sandoz India Limited, 1,514 Kgs., Rs. 2,27,134.

OCTOIC ACID: From FRG: Aryavart Chemicals Pvt. Ltd., 14.43 MTs., Rs. 2,45,646.

PARA NITROANILINE TECH.: From FRG: Pridor Chemicals and Extrusions Private Limited, 470 Kgs., Rs. 3,34,675.

PARAFORMALDEHYDE 91%: From Spain: Ion Exchange India Limited, 1,800 Kgs., Rs. 1,50,381.

PARAFORMALDEHYDE 91% PRILLS: From Spain: Sunidhi, 1,800 Kgs., Rs. 1,43,432.

PERCHLOROETHYLENE: From Italy: Goel Brothers, 18.48 MTs., Rs. 1,44,990.

PHENYL XYLYL ETHANE: From Japan: Hind Condensor Ltd., 4,000 Kgs., Rs. 1,35,633; Shreem Capacitors, 9,000 Kgs., Rs. 2,67,728.

POTASSIUM CARBONATE 99% GRANULES: From France: Kantilal Manilal & Co., 18,000 Kgs., Rs. 1,96,337.

PROPYLENE GLYCOL USP: From USA: M.J. Exports Ltd., 8,385 Kgs., Rs. 1,83,387.

PROXEL XL-2: From UK: BASF India Ltd., 500 MTs., Rs. 44,184.

SILICA FUMED: From Belgium: Acropolymers Pvt. Ltd., 480 Kgs., Rs. 52,725; Bombay Paints & Allied Pvt. Ltd., 600 Kgs., Rs. 54,922.

SODIUM CHLORITE: From FRG: Colour Chem Ltd., 1,150 Kgs., Rs. 37,823.

SODIUM FORMALDEHYDE SULPHOXYLATE: From China: AUM Chemical Corporation Ltd., 16 MTs., Rs. 2,64,484; From Czecho vakia: Associated Brothers, 6,000 K Rs. 1,11,833; From China: Vi Commercial Corpn., 16,000 K Rs. 2,71,266.

THIOUREA: From FRG: Ind Dyestuffs Inds. Ltd., 400 K Rs. 1,45,127.

TITANIUM DIOXIDE: From Chi Bhuta Overseas Co., 57.225 MT Rs. 12,12,751.

TRICHLORO ISOCYANUR ACID: From Spain: Ion Exchange In Ltd., 900 Kgs., Rs. 39,496.

TRIMELLITIC ANHYDRID From USA: Amines & Plasticizers Lt 3,600 Lbs., Rs. 7,00,376.

3,4,5 TRIMETHOXY BENZA DEHYDE: From Japan: Orex Pharm Pvt. Ltd., 4,020 Kgs., Rs. 16,15,281

VANILLIN CRYSTALS: Fro Norway: S.M. Kelkar and Co. Lt 5,200 Kgs., Rs. 13,65,674.

ZINC OXIDE POWDER: Fro USA: Elpro International Ltd., 550 Lbs Rs. 1,03,180.

PLASTIC MATERIALS IMPORTED BOMBAY (From 28.11.89 to 29.11.89)

HDPE: From Czechoslovakia: Asso ciated Brothers, 12.5 MTs., Rs 1,32,234; From Hungary: Metal Impex 230 MTs., Rs. 26,51,624; Novo Impex 250 MTs., Rs. 28,82,200; From Japan Jhaveri Polymers Pvt. Ltd., 50 MTs. Rs. 6,47,120; From Saudi Arabia: Com fort Rubbers Inds., 17,150 Kgs., Rs 2,23,888; Diamond Polyprints, 17,150 Kgs., Rs. 2,23,888; G.N. Plastipack 17.15 MTs., Rs. 2,23,888; Halol Synthetics Pvt. Ltd., 17.15 MTs., Rs 2,23,888; Jaydev Packaging, 17.15 MTs., Rs. 2,23,888; Nobel Imports Pvt Ltd., 82.5 MTs., Rs. 9,44,134; Plastika Industries, 51.45 MTs., Rs. 6,62,945; Regent Plastics, 17,150 Kgs., Rs. 2,23,888; Shreenath Dyechem Inds.,

15 MTs., Rs. 2,45,695; Silver Plas-
hem Pvt. Ltd., 51.45 MTs.,
6,58,578; Texco Plant, 51.45 MTs.,
6,62,945; From Singapore: Futura
kaging India Ltd., 15.17 MTs.,
2,23,373; Metal Impex, 20 MTs.,
2,30,576; From Yugoslavia: Abhi-
k Corpn., 9 MTs., Rs. 1,16,493; For-
a Agencies, 110.4 MTs.,
2,87,698.

LDPE: From Qatar: Bright Brothers
l., 16.5 MTs., Rs. 2,12,605.

LLDPE: From Japan: The Supreme
ls. Ltd., 32 MTs., Rs. 4,56,899; From
udi Arabia: Diamond Polyplast Pvt.
d., 49.5 MTs., Rs. 5,16,126; Essge
astics Pvt. Ltd., 49.5 MTs.,
. 5,35,929; Fusion Polymers Ltd.,
.5 MTs., Rs. 1,81,833; HGF Lami-
tes, 49.5 MTs., Rs. 5,03,538; Kuppi
padan, 49.5 MTs., Rs. 5,28,714;
ulti Polyfilms Pvt. Ltd., 33 MTs.,
. 1,57,286; Plasto Metachem Pvt.
d., 81.625 MTs., Rs. 7,26,790.

POLYETHYLENE: From Sweden:
ndhya Telelinks Ltd., 75.125 MTs.,
. 16,81,745.

POLYPROPYLENE: From Austra-
: Hindustan Vacuum Glass Ltd., 16
Ts., Rs. 2,23,457; From Brazil: The
ooghly Mills Co. Ltd., 100 MTs.,
. 15,58,451; From Canada: Gujarat
opack Ltd., 1,16,875 Kgs.,
.. 17,83,364; From Czechoslovakia:
sociated Brothers, 10.15 MTs.,
Rs. 1,43,947; From France: Cosmo Films Ltd., 4,825 Kgs., Rs. 8,04,916; From Spain: Gem Properties Pvt. Ltd., 16.5 MTs., Rs. 2,78,409; From Italy: Ami Enterprises, 1,500 Kgs., Rs. 2,11,879.

POLYSTYRENE (Expandable): From Korea: Thermo Packaging Inds., 12 MTs., Rs. 2,95,741.

POLYSTYRENE: From Korea: Godrej & Boyce Mfg. Co. Ltd., 85 MTs., Rs. 15,17,695.

POLYSTYRENE RESIN: From Korea: Nutherm Insulations, 12 MTs., Rs. 2,91,852.

PVC: From Brazil: Avon Inds., 50 MTs., Rs. 6,48,801; Bharat Pipes & Fittings Ltd., 550 MTs., Rs. 68,11,207; Bhhagirath Agro Plast P. Ltd., 50 MTs., Rs. 6,98,400; Finolex Pipes Ltd., 2,000 MTs., Rs. 2,79,74,337; International Polymers, 5,000 Kgs., Rs. 6,48,476; J.K. Leatherite Pvt. Ltd., 100 MTs., Rs. 14,52,578; Kanchan Pipes Pvt. Ltd., 100 MTs., Rs. 13,62,573.

PVC RESIN: From Brazil: Kundalia Industries, 50 MTs., Rs. 7,22,943; Mahabir Chemical Inds., 75 MTs., Rs. 9,31,451; Sanghi Leathers Pvt. Ltd., 150 MTs., Rs. 18,64,848; Universal Cables Ltd., 100 MTs., Rs. 14,85,126; From FRG: Burroughs Wellcome Ltd., 600 Kgs., Rs. 12,80,780; From Korea: Caprihans Inds. Ltd., 200 MTs., Rs. 31,55,505; Sudeep Inds., 20 MTs., Rs. 2,73,227; Uniplas India Ltd., 300 MTs., Rs. 38,29,608; From Mexico: Master Plastic Bottle Mfg. Pvt. Ltd., 49.95 MTs., Rs. 6,47,397; From Saudi Arabia: Ashish Cheme Plant Eqpt. Pvt. Ltd., 140 MTs., Rs. 17,92,349; From Yugoslavia: Caprihans India Ltd., 5,000 Kgs., Rs. 6,95,926.

PTFE RESIN: From USA: Mechanical Packaging Inds. Ltd., 10,000 Kgs., Rs. 2,36,424.

DRUG MATERIALS IMPORTED BOMBAY
(From 28.11.89 to 29.11.89)

CALCIUM D-PANTOTHENATE USP: From Japan: The Anglo French Drug Co. Ltd., 1,000 Kgs., Rs. 2,27,185.

FURAZOLIDONE NF: From Hungary: G. Amphray Laboratories, 4,000 Kgs., Rs. 5,49,314.

MANNITOL USP: From Brazil: Kushalchand & Co., 1,125 Kgs., Rs. 4,15,875.

NEOMYCIN SULPHATE BP 80: From China: Western Chemicals, 100 Kgs., Rs. 1,25,116.

NOVOLDIAMINE: From FRG: Sharvani Pharmaceuticals Ltd., 1,980 Kgs., Rs. 6,95,622.

D-PANTHENOL USP: From Japan: The Anglo French Drug Co. Ltd., 250 Kgs., Rs. 72,953.

PHENOBARBITONE IP: From USSR: Modi Pharma Drug House, 510 Kgs., Rs. 86,323.

DYE MATERIALS IMPORTED BOMBAY
(From 28.11.89 to 29.11.89)

DISPERSE DYES: From FRG: Avni Dye Chemicals, 550 Kgs., Rs. 1,49,212.

DYE INTERMEDIATES: From Japan: Yogesh Dyestuff Products Pvt. Ltd., 400 Kgs., Rs. 93,679.

RHODAMINE 2B LIQUID: From FRG: BASF India Ltd., 420 Kgs., Rs. 54,876.

MATERIALS IMPORTED MADRAS
(From 1.12.89 to 5.12.89)

ACETIC ANHYDRIDE: From Japan: Srinivasa Agro Inds. & Drugs Pvt. Ltd., 32,000 Kgs., Rs. 4,93,997.

ACETYLENE BLACK: From Singapore: Indo National Ltd., 25,800 Kgs., Rs. 7,55,905; Union Carbide India Ltd., 7,240 Kgs., Rs. 1,91,119.

ALUMINIUM OXIDE: From FRG: Grindwell Norton Ltd., 900 Kgs., Rs. 62,750.

AMMONIUM ADIPATE: From FRG: Keltron Component Complex Ltd., 1,000 Kgs., Rs. 63,018.

AMMONIUM PENTABORATE: From FRG: Keltron Component Complex Ltd., 2,500 Kgs., Rs. 1,37,711.

PARA ANISALDEHYDE: From Japan: Cheminor Drugs Ltd., 4,050 Kgs., Rs. 5,57,884.

ANTIMONY OXIDE: From Japan: Fenner India Ltd., 10,000 Kgs., Rs. 5,04,566.

AROMATIC CHEMICALS: From France: Karnataka Soaps & Detergents, 800 Kgs., Rs. 2,03,642; Vasu Agarbathies, 355 Kgs., Rs. 74,097; Vinarom Pvt. Ltd., 50 Kgs., Rs. 17,714; Fr Netherlands: B.V. Aswathiah & Br 100 Kgs., Rs. 88,147; Vasu Agar thies, 200 Kgs., Rs. 56,587.

BENZALDEHYDE FFC GRAI From Netherlands: Malladi Drugs Pharm, 15,600 Kgs., Rs. 4,51,812.

CALCIUM NITRATE: Fr Malaysia: Kemwell Intl. Pvt. Ltd., 3,3 Kgs., Rs. 1,50,376.

CALCIUM SILICIDE: From Ne erlands: Metal Powder Co. Ltd., 39,0 Kgs., Rs. 10,30,364.

CARBON ACTIVATED: Fr Netherlands: ICI India Ltd., 240 Kg Rs. 16,925.

4-CYANOPYRIDINE: From Japa Veer Chemie & Aromatics, 5,000 Kg Rs. 4,17,464.

DESMODUR L-75: M.M. Rubb Co. Ltd., 1,200 Kgs., Rs. 72,498.

DIBUTYL PHTHALATE: Fro UK: Southern Capsulation Service Pv Ltd., 25 Kgs., Rs. 10,290.

2,6-DIMETHYL CYCLOHEXAN From Switzerland: Bush Boake Alle India Ltd., 25 Kgs., Rs. 36,490.

ETHANE: From Japan: Electron Research Ltd., 1,080 Kgs., Rs. 25,81

HYDROXY CITRONELLAL: Fro France: Padmini Products, 200 Kgs Rs. 1,10,219.

ISOBUTYL BENZENE: From USA Cheminor Drugs Ltd., 81,942 Kgs Rs. 44,82,972.

LAB CHEMICALS: From USA Astra Research Centre India, 20 Nos Rs. 23,242.

LACTIC ACID: From Hong Kong Tamilnadu Dadha Pharm., 34,000 Kgs. Rs. 6,29,866.

LILIAL: From Switzerland: Vasu Agarbathies, 300 Kgs., Rs. 54,718.

L-LYSINE MONO HCl: Fron Korea: Oscar Feeds, 3,000 Kgs Rs. 1,93,066.

MERCAPTOBENZIMIDAZOLE: From Japan: Shriram Fibres Ltd., 2.5 MTs., Rs. 4,67,575.

METHYL ACETOACETATE ESTER: From Japan: Shri Siddhi Vinayak Enterprises, 64,000 Kgs., Rs. 7,01,042.

METHYL CHLOROFORMATE: From Hungary: N. Arvind & Co., 2,000 Kgs., Rs. 45,726.

ALPHA NAPHTHOL: From Japan: ICI India Ltd., 2,000 Kgs., Rs. 2,32,749.

NEO PENTYL GLYCOL: From USA: Kopalle Pharma Chemicals Pvt. Ltd., 9,080 Kgs., Rs. 1,98,887.

PROPYLENE GLYCOL TECH.: From USA: Naphtha Resin & Chemicals Ltd., 17,200 Kgs., Rs. 3,49,552.

SILICON DIOXIDE: From Hong Kong: Venlon Polyester Film Ltd., 200 Kgs., Rs. 15,437.

TETRA BUTYL AMMONIUM BROMIDE: From Italy: Cheminor Drugs Ltd., 10,000 Kgs., Rs. 14,22,210

THIOUREA: From Japan: Pradeep Drug Co., 3,000 Kgs., Rs. 1,01,637.

TITANIUM DIOXIDE: From Singapore: Intl. Trading Co., 20,000 Kgs., Rs. 4,57,262; From Switzerland: Sudha Chemicals, 225 Kgs., Rs. 29,973; From USA: Tushar Enterprises, 18,140 Kgs., Rs. 4,49,716.

TRIMETHYL PHOSPHATE: From USA: Indag Products Ltd., 14,651 Kgs., Rs. 5,55,806.

3,4,5 TRIMETHOXY BENZALDEHYDE: From Netherlands: Prasad Drugs Pvt. Ltd., 5,000 Kgs., Rs. 19,48,083.

PLASTIC MATERIALS IMPORTED MADRAS
(From 1.12.89 to 5.12.89)

HDPE: From Japan: Rabbani Exports, 32.2 MTs., Rs. 4,23,654; From Netherlands: Lalith Polysacks (P) Ltd., 17 MTs., Rs. 2,08,732; From Singapore: Asian Peroxides Ltd., 17,000 Kgs., Rs. 2,33,204; From USA: International Plastics, 13.608 MTs., Rs. 1,60,170.

POLYPROPYLENE: From Netherlands: Sri Narasimha Plastics Inds., 42 MTs., Rs. 5,25,753; From Singapore: Lakshmi Polypacks, 16 MTs., Rs. 2,27,615; Swarnarathinam Inds., 32 MTs., Rs. 4,60,550; VPS Ayyamperumal Nadar & Sons, 32,256 Kgs., Rs. 4,58,220; From USA: Chakra Circular Sacks, 17 MTs., Rs. 2,19,807.

POLYSTYRENE: From Korea: Dar International, 51 MTs., Rs. 5,58,306; Universal Polychem, 440 MTs., Rs. 37,06,733.

DYE MATERIALS IMPORTED MADRAS
(From 1.12.89 to 5.12.89)

BRILLIANT PINK R: From Hong Kong: H.I. Rafeeque Ameen & Co., 540 Kgs., Rs. 54,871.

DYES: From Hong Kong: H.E. Rafeeque Ameen Ltd., 2,000 Kgs., Rs. 1,01,614.

DYESTUFFS: From Spain: Namaste Leather Garments, 2,100 Kgs., Rs. 4,10,438; Safique Leather, 1,000 Kgs., Rs. 4,64,846; From Switzerland: Namaste Leather Garments Ltd., 900 Kgs., Rs. 1,80,569.

SAVINYL BLACK RLS: From FRG: Farida Prime Tannery, 100 Kgs., Rs. 69,281.

DRUG MATERIALS IMPORTED MADRAS
(From 1.12.89 to 5.12.89)

HYDROXYLAMINE SULPHATE: From Japan: Eskayef Ltd., 25,000 Kgs., Rs. 6,67,965.

LACTOSE BP/USP/IP 200 MESH: From New Zealand: Medopharm 18,000 Kgs., Rs. 2.55.208.

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